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TEXT-BOOK

OF

GYNECOLOGICAL DIAGNOSIS

BY

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WITH THE COLLABORATION OF

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AFTER THE THIRD REVISED GERMAN EDITION

ILLUSTRATED BY FOUR FULL PAGE PLATES AND THREE HUNDRED AND FORTY-SIX TEXT ILLUSTRATIONS IN BLACK AND COLORS

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[illegible]

TO MY ESTEEMED

MASTER

ROBERT OLSHAUSEN

THIS WORK IS DEDICATED IN UNALTERABLE

GRATITUDE

PREFACE TO THE ENGLISH EDITION

THE history of American gynecology is replete with brilliant achievements, and much of the pioneer work of such pathfinders as McDowell, Sims, the Atlees, Hodge, Emmet, Skene, Goodell, and others, has been incorporated in the basic principles of modern diagnosis and treatment of the diseases of women. This work so conspicuously begun by our countrymen has been worthily maintained by a large number of skilled successors, who are still in the zenith of their careers.

Although much has been established in the practice of gynecology in the United States, we owe much nevertheless to English and Continental gynecologists for the discovery and inauguration of many essentials in theory and practice, and especially must we pay tribute to the painstaking research of German specialists, who have been indefatigable co-workers in creating from a minor field a great specialty, which takes equal rank with other representative branches of medicine. To their epoch-making discoveries in embryology, to their careful elaboration of the topographical anatomy and histology of the generative organs, to their infinite patience in the investigation of questions relating to the pathology and bacteriology of the diseases of women, to their establishment of various principles relating to surgical and therapeutic treatment, and to their faithful study of the ultimate results of operative measures we may attribute much of the progress of this specialty.

Of the younger school of German gynecologists, Professor Winter occupies a representative position, and his experience as a teacher of gynecology, first in the University of Berlin, and later in the University of Königsberg, has amply fitted him to write a practical book on gynecologic diagnosis, judiciously leavened, but not overburdened, with the science of this subject. The text is clear and concise, and is so effectively illustrated that all important points are brought out in sharp relief.

In addition to the practical part of the book, which has been so carefully prepared by Professor Winter, Professor Carl Ruge, the distinguished investigator and teacher of microscopic diagnosis, has contributed a very valuable section on this subject and its important bearing upon the etiology, diagnosis, and treatment of the diseases of women. That the laboratory must frequently be the court of final resort in the early diagnosis of cancer is convincingly demonstrated by this master.

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Therefore, because of the merit of this German text-book, it is a pleasure to stand sponsor for this English translation.

While in general the principles of gynecology are, with minor variations, identical the world over, nevertheless each country shows national preferences. In order to adapt this translation to American use, brief editorial annotations have been made here and there, which have appeared essential to the wider adaptation of the book to this country. These comments are contained in separate editorial paragraphs, enclosed in brackets, thus leaving the translated German text intact.

To Dr. R. Max Goepp are due the thanks of the editor for his splendid translation, which has faithfully preserved the author's meaning and yet has clothed it in most attractive English.

JOHN G. CLARK.

2017 WALNUT STREET, PHILADELPHIA, 1908.

PREFACE TO THE THIRD EDITION

THE completion of the third edition has been very much delayed by other literary undertakings. During the ten years that have elapsed since the appearance of the second edition, gynecological diagnosis both clinically and pathologically has been greatly developed. With the increase in my experience and my removal to another field my views and their formulation also underwent certain important alterations. For this reason I felt it my duty to subject the entire text-book to a thorough revision and especially the following portions: general diagnosis, extra-uterine pregnancy, retroflexio uteri, myoma, carcinoma of the uterus, diseases of the vulva and vagina, and diseases of the urinary apparatus. My collaborator, Carl Ruge, has rewritten his contributions to the book on a considerably enlarged scale. The illustrative portion also has received alterations and additions, the number of illustrations having been almost doubled. The clinical portion contains a number of new, mostly colored illustrations, prepared by the able hand of Miss G. Burdach of Königsberg. Gebhard's photograms have been replaced by original drawings from the pencil of Mr. Richter.

Once more I wish to express my sincere thanks to the publishing firm of S. Hirzel, of Leipzig, who have always shown their readiness to carry out my wishes, exacting though they might be.

G. WINTER.

KÖNIGSBERG, February, 1907.

PREFACE TO THE FIRST EDITION

(1896)

GYNECOLOGICAL diagnosis has made tremendous strides during the last decade. Above all, the method of combined examination has gained so much in accuracy, from constant comparison of the palpatory findings with the conditions revealed by laparotomies, that it now furnishes a reliable foundation for diagnosis. It is chiefly owing to combined examination that gynecological diagnosis has become a science and a study of considerable importance and extent. While every text-book on gynecology devotes a large share of its pages to diagnosis, this very fact not only justifies but indeed demands a special treatment of the subject; and, except for Veit's "Gynäkologischen Diagnostik" (1890–1891), no text-book especially devoted to gynecological diagnosis has yet appeared either in the German or in the foreign literature.

The fact that I have for eight years been engaged in teaching gynecological diagnosis is my reason for writing such a book. During these years I have been constantly striving to perfect my subject and have had ample opportunity to test my views and manner of presentation in the class-room. As for the requirements of the practitioner, I have tried to meet them by devoting special attention to those diagnostic points which I have found to be most important in the many years of my close association with physicians. In this way I have closely followed my teaching in writing this text-book and accordingly hope it may prove useful both to students and to those engaged in active practice.

A great deal of space has been devoted to microscopical diagnosis because I have become more and more convinced of its value. To my great joy, I succeeded in securing as a collaborator for this part of the work Carl Ruge, the creator and assiduous promotor of this method, so that his teaching and experience, which are of such great value to practical gynecology, are at last to be given permanence by appearing in printed form.

With regard to the illustrations I have the following communication to make:

The microscopic illustrations I owe to my colleague Gebhard. They are autotypic reproductions of his excellent micro-photographs,

and, owing to their absolute truth to nature, offer to the microscopist the surest foundation for his diagnosis.

The illustrations which represent palpatory findings were obtained by making careful measurements on the living subject and transferring them to Schultze's rubber stamps, and they accordingly represent useful material for scientific purposes.

The originals for the wood-cuts were prepared according to my directions by Mr. Paul Richter, can. med. of Berlin.

I also wish to express publicly my thanks to Mr. Hirzel, of Leipzig, for his ever ready and obliging courtesy, which has made my association with him such a constant pleasure.

G. WINTER.

EASTER, 1896.

The second edition appeared with very little change in 1897 and was translated into Italian.

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TEXT-BOOK
OF
GYNECOLOGICAL DIAGNOSIS

General Diagnosis.

THE purpose of a gynecological examination is to determine the condition of the female genitalia and adjacent organs.

We have the following methods at our command:

External examination;
Internal examination;
Combined examination;
Rectal examination.

Auxiliary methods of examination are:

The employment of vaginal specula;
The uterine sound;
Dilatation and palpation of the uterine cavity;
Anatomical (microscopic) diagnosis;
Cystoscopy;
Bacteriologic diagnosis;
Radiography.

External Examination.

By means of the external examination of the abdomen changes in the genitalia and adjacent structures developing above the pelvic inlet are determined. It is employed in cases of large tumors of the uterus and ovaries, advanced intra-uterine and extra-uterine pregnancy, ascites, diseases of the kidneys, spleen and liver, so-called pseudotumors produced by obesity or meteorism, and for the purpose of determining a painful area in the abdominal cavity.

The physician should always begin by making an external examination, or he will be in danger of overlooking changes in the upper portion of the abdominal cavity, such as high ovarian tumors.

In making an external examination the patient should be placed on an examining-couch or table, with the trunk slightly elevated and the legs drawn up. Usually, the abdomen must be exposed.

Inspection of the abdomen is employed for the determination of certain characteristic changes in shape, such as increased width and flatness of the abdomen in cases of freely movable ascites, or the rounded or conical protruding abdomen in cases of tumor, pregnancy and encapsulated ascites; also for studying changes in the skin (striæ, pigmentation, dilated veins) and the umbilicus.

Inspection.

By inspection of the external genitalia we determine changes in the pubes, perineum and lower portion of the vaginal mucous membrane. As the inspection of the sexual organs offends the woman's sense of modesty most, it should be employed only in the event of disease of the external genitalia, or when there is reason to think that the findings may have an important bearing on the diagnosis of diseases of the internal genitalia. The inspection of the external genitalia should be made at the end, and not at the beginning of the general examination. A glance at the patient's linen may show the quantity and character of the discharge or flow of blood that may be present.

Palpation is the most important part of the external examination. The examiner places both hands flat on the abdomen and, while making uniform pressure, seeks to determine the contents of the abdominal cavity, chiefly with the aid of his finger tips. The hands must be warm and dry, and only moderate pressure must be made. Palpation consists principally in determining differences in consistency between tumors that are more or less hard and the surrounding intestines. The greater this difference, as for example in the case of a hard myoma, the easier it is to feel the tumor and to determine its boundaries; the smaller the difference, as for example in the case of the gravid uterus, the greater will be the difficulty experienced in palpation. By means of palpation the shape, mobility and contents of tumors are recognized. When the examination is made for the purpose of determining a painful area in the abdomen, very gentle pressure must be used in order not to be misled by pain due to the pressure itself; the boundaries of the painful area are accurately mapped out with the finger tips. The relaxation of the abdominal walls necessary for satisfactory palpation is best secured by elevating the trunk and having the patient draw up both knees; if the intestines are distended with fecal matter they must first be emptied by a laxative. In examining tumors situated in one side of the abdomen the patient should be made to lie on the opposite side. In this position the intestines gravitate to the bottom and permit direct palpation of the tumor.

Palpation.

Percussion is employed as an auxiliary to palpation when the abdominal walls are so thick and tense that they resist the pressure of the examiner's hands, or the tumors are so relaxed that their outlines cannot be determined by palpation. Percussion is indispensable in the demonstration of free fluid in the abdomen (ascites, blood, pus). Percussion is principally employed to distinguish between the tympanitic note obtained over the stomach and intestines and the dull sound over a tumor or accumulation of fluid. All tumors in close contact with the abdominal walls, whether solid or cystic, are dull on percussion; in exceptional cases the note is tympanitic from the presence of gases of decomposition; as, for example, in an extra-uterine pregnancy sac, hydronephrosis, ovarian tumors. A modified tympanitic percussion note is obtained in the case of tumors with adherent intestines, small collections of fluid between the intestines, and inflammatory and carcinomatous tumors situated among coils of intestine. Percussion.

It is best to percuss along a line perpendicular to the supposed boundary, which usually runs in a circle around the umbilicus, as most large tumors are spherical in shape and situated in the median line, and the surface of the fluid in ascites is usually parallel to the horizontal plane. We begin at the highest point of the abdomen because at this point we always expect to find dulness in the presence of tumors, and resonance (tympany) if there is ascites. Percussion is then continued upward toward the xiphoid process, downward toward the symphysis, to each side toward the region of the kidneys and, if necessary, along intermediate radii. Percussion should be light in order to exclude the intestinal tympany, which tends to obscure the outlines obtained by percussion. As a rule, in the case of tumors, the outlines obtained by percussion and palpation should coincide.

Auscultation, in gynecology, is practically employed only in the diagnosis and differential diagnosis of pregnancy, for the purpose of demonstrating fetal movements, the fetal heart sounds, and the uterine bruit. The remaining auscultatory phenomena, such as intestinal noises, uterine and arterial sounds, have little or no bearing on gynecological diagnosis. A stethoscope with a large bell is to be preferred on account of the ease and rapidity with which the various sound phenomena can be located. Auscultation.

Internal Examination.

Internal examination is performed with the finger introduced into the vagina and is employed to determine alterations in the vagina and portio vaginalis. Occasionally it is possible to palpate, more or less indistinctly, tumors lying upon the vaginal vault, which originate either in the supravaginal portion of the cervix or in the parametrium,

or in Douglas's space. Whether or not it is possible to determine the character and outlines of such tumors with the accuracy required for a positive diagnosis will depend on the degree of resistance of the vaginal wall.

At the present day the internal examination forms merely a part of the combined examination, *i.e.*, as soon as the condition of the vagina has been determined, the external hand is placed on the abdomen for the purpose of investigating, by bimanual palpation, all the organs situated above the vaginal vault. In those cases in which the resistance of the abdominal walls is so great as to render the combined palpation absolutely impossible, as, for example, in many cases of retroflexion, the internal examination is the only method of palpation at our disposal and in such cases is extremely valuable.

Combined Examination.

In its narrow sense the combined examination means palpation of the internal genitalia through the vagina and through the abdominal walls; in its broader sense it includes also a combined examination through rectum and abdominal walls, and through rectum and vagina.

Combined examination through vagina and abdominal walls constitutes gynecological examination proper and forms the basis of gynecological diagnosis. Combined examination is very difficult to learn and to the beginner seems like an impenetrable mystery; but once it has been mastered, the method enables the examiner to make palpatory diagnostications with almost incredible accuracy. Such skill, however, can only be acquired by assiduous study and retained by constant practice. A thorough touch-course and constant training in private practice are both equally indispensable.

For the successful performance of a combined examination the following points are important:

Position of Patient. In making a gynecological examination it is important that the patient's position be comfortable and decent, and such as to permit as accurate palpation of the pelvic organs as possible. These two requirements cannot always be satisfied at the same time and to the same degree. If we pay proper attention to decency, the patient's position is not suitable for a successful examination. The greatest difficulty experienced in the combined examination is the tension of the abdominal muscles. In order to bring about a relaxation of the abdominal walls, the insertions of the muscles, *i.e.*, the lower border of the thorax and the upper border of the pelvis, must be approximated as much as possible. Hence the patient should be placed in such a position that the trunk is flexed on the anterior plane, which may be effected by elevating both the trunk and the pelvis (dorso-coccygeal position). The trunk should be raised

Position of Patient.

on a bed-rest or pillows, the head being firmly supported because contraction of the muscles supporting the head causes tension of the abdominal walls. Approximation of the upper rim of the pelvis is obtained by flexing the thighs at the hip-joint. The closer they are brought to the body, the greater will be the elevation of the pelvis and, therefore, the more thorough the relaxation of the abdominal walls; but it is this very elevation of the legs that renders the position indecent, hence complete elevation is possible only under full anesthesia.

The above principles must be observed in the construction of the examining-table. If the examination is to be made at the patient's home, the examiner must make his choice between the bed and a lounge. The physician sits on the edge of the bed or couch and makes his examination while the woman, whose body has been raised to an angle of about 45 degrees, flexes her thighs on the abdomen, so that the legs are approximately vertical and in marked abduction. The position is comfortable for both physician and patient and permits a thorough palpation of the internal genital organs. A more accurate examination can, however, be made by placing the patient crosswise on the bed, with the trunk moderately elevated and the coccyx on the edge of the bed, the legs being at the same time strongly flexed in abduction and held by two other persons or supported on two chairs. The examiner is seated on a chair between the woman's legs. As this position is distressing to the patient, it should be employed only in cases of necessity and especially when a general anesthetic is given.

[Several gynecological chairs and tables are on the market in the United States, all of which have special advantages along with disadvantages. The consensus of opinion among gynecologists is against mechanical chairs. They are too cumbersome and possess little advantage over a small examining-table. The latter should be so constructed that it can be dismantled at the end of an office hour and converted into a small, sightly table. Every physician should endeavor so to order his office that all objects are concealed that may offend or shock his patients. For this reason, in a private examining-room, instruments should never be in view even when in use, for to patients who may be very nervous, the mere sight of a speculum may be sufficient to engender hysterical manifestations, or at least so to agitate them that the examination is at best most unsatisfactory. Therefore, in selecting an examining-table, that one which is the simplest and most free from obvious mechanical arrangements is preferable.—EDITOR.]

The same careful attention should be paid to decency and to the patient's comfort when gynecological patients are examined in the office. The examining-couch unquestionably satisfies these two requirements better than anything else: it permits external examination in

the most satisfactory manner and, by elevating the trunk and having the patient draw the legs up, it is possible in most cases to make a sufficiently accurate combined examination. The external genitalia can be inspected, the sound can be introduced, glass specula employed, massage performed, and the parts cauterized, etc. In general, therefore, the use of the examining-couch is to be recommended: but it does not suffice in every case. If extreme elevation of the legs or even of the pelvis is necessary for the purpose of thoroughly relaxing the abdominal walls, if examination on the couch has not given a trustworthy result, or if a Simon or Sims speculum is to be introduced, the patient must be

FIG. 1.—EXAMINING-CHAIR. (Original.)

placed on an examining-chair. The position on the chair is the same as that described above when the woman is placed crosswise on the bed, and unquestionably permits more accurate palpation of the internal genitalia. The only bar to its general employment is the objectionable position. Veit-Schröder's chair is the best for practical purposes, and by suitable upholstering and a judicious use of covers much can be done to make it look less formidable. As it does not permit of the horizontal position, however, part of the examination must be made on the couch. For this reason a chair with a movable back and leg-supports (Fig. 1), so that the patient's position can easily be changed from the vertical to the horizontal, is more suitable for a small consulting room. Examining-chairs provided with ratchets and other mechanical appliances

for bringing the patient suddenly into the desired position are not to be recommended, as they only frighten and agitate the patient.

Trimanual Method of Percussion.

[In the abdominal tumors of women, the combination of touch and palpation in the bimanual pelvic examination is by far the most efficient means of diagnosis at our command.

The tactile sense, naturally, becomes more and more acute with increasing experience, so that structures which to the novice are un-

FIG. 2.—EXAMINING-ROOM EQUIPPED AND READY FOR OFFICE WORK. The table is uncomplicated and has no obtrusive mechanism to frighten a nervous patient. All instruments are kept in close touch with the examiner but are concealed by a sterile towel.

recognizable may easily be outlined when a sufficient *tactus eruditus* is acquired. In my own experience the chief difficulty in the differential diagnosis in obscure cases has been in judging the consistence of a tumor or encapsulated mass as to whether it was fluid or solid. This differentiation is of vital importance in many cases. Thus, for instance, an adherent soft intraligamentary myoma, associated with inflammatory

disease of the appendages, may closely simulate a pelvic abscess. In fact, even in skilled hands, a vaginal incision or puncture may be made into a soft tumor mass in the thought that it is encapsulated pus. Similar errors in diagnosis may frequently occur in other parts of the abdomen. Thus a tense hydro- or pyosalpinx may be mistaken for a solid tumor; a distended gall-bladder for a tumor of the liver or kidney; a deep-seated collection of pus about the appendix for a tumor of the cecum or omentum. These mistakes may, in some instances, be unavoidable, notwithstanding the greatest refinement in physical diagnosis.

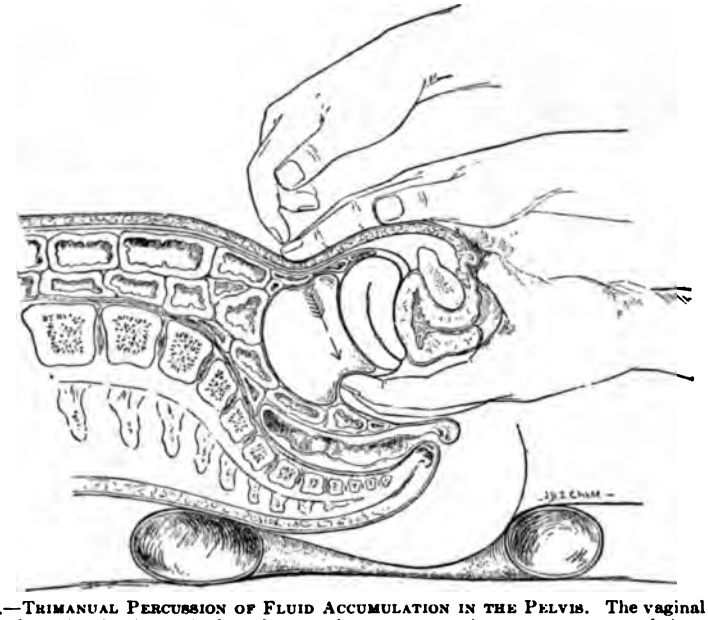


FIG. 3.—TRIMANUAL PERCUSSION OF FLUID ACCUMULATION IN THE PELVIS. The vaginal index finger makes deep indentation in the vaginal vault posterior to the cervix, counter-pressure being made by the abdominal hand pressing down against the tumor mass, thus collapsing or displacing the intestine, while the assistant lightly percusses the tip of these fingers.

For the detection of fluid, in these obscure cases, I have employed for several years a trimanual method of percussion, which has, in several cases, proved of signal value, at once clearing up an otherwise doubtful diagnosis. This method was first employed as a means of differentiation between fluid and solid pelvic tumors. On bimanual examination of a pelvic mass of questionable consistence, the intestines intervening between the anterior abdominal wall and the tumor may dissipate the percussion impulse of the abdominal hand, and although fluid may be present, a wave of sufficient intensity to be felt by the vaginal touch is not induced. To overcome this difficulty the tumor mass should be confined as closely as possible between the two examining hands, while the percussion is made by an assistant. With light, quick taps, even small collections of fluid may be detected by the quick,

responsive, pulsatile wave passing from the abdominal to the pelvic hand (Fig. 3). Since proving the value of this method in pelvic examinations, I have systematically employed it in the differential diagnosis of abdominal tumors. In this way an adherent and distended gall-bladder may accurately be diagnosticated, one hand pressing deeply in over the hypochondrium, while with the other deep counter-pressure is made just below the fixed ribs (Fig. 4). If fluid is present, light percussion over the upper hand will give an unmistakable wave in many instances. In one case this method proved of considerable value in the differentiation of an appendical abscess situated beneath the cecum

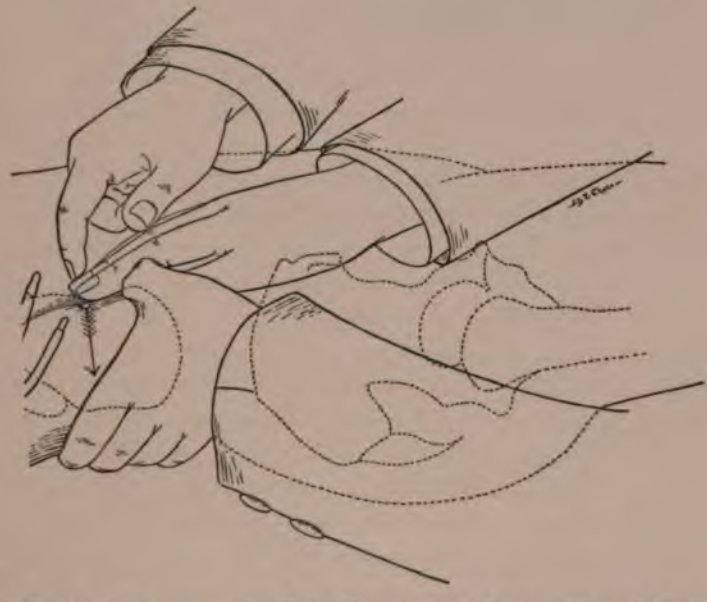


FIG. 4.—TRIMANUAL PERCUSSION OF FLUID TUMOR IN THE REGION OF THE LIVER AND KIDNEY. One hand is sunk deeply into the loin, slightly posterior, thus pushing up as far as possible the tumor, while the other hand presses downward against the tumor. Percussion is then made by the assistant the same as in the pelvic examination.

and the lower lobe of a downward displaced liver. Only through the employment of this method was it possible definitely to recognize the deep-lying encapsulated pus, the ordinary percussion wave being destroyed by the superimposed liver. I find this method of signal value, for it is of great assistance in clearing up doubtful cases which hitherto have only been definitely settled by an exploratory incision.—EDITOR.]

For special purposes other positions are also required:

Examination in the Freund (Trendelenburg) position (W. A. Freund) permits more accurate examination of the internal genitalia because the extreme elevation of the pelvis allows the intestines, ascitic fluid, and movable tumors, to fall against the diaphragm,

and frees the genital organs from neighboring structures that interfere with palpation. The Trendelenburg position is obtained by elevating the patient in the usual way on an operating-table, or by placing the head and shoulders on the floor or couch and having two assistants seize the thighs and elevate the pelvis, the examiner standing between the woman's legs.

Examination in the Freund Position.

Examination in the standing posture is employed only in the diagnosis of prolapse, because it enables the examiner to determine the degree of displacement of the vagina and uterus produced by standing and by the patient's ordinary occupation. The shape of a pendulous abdomen and the degree of relaxation can also be determined best when the woman is standing. The younger Freund also recommends the position for the bimanual palpation of the lateral and posterior walls of the pelvis. The examiner sits on a chair, or kneels on one knee, and introduces the finger into the vagina underneath the clothing. As the situation is distressing to the patient, this method of examination should be avoided as much as possible. Combined examination in the standing posture is impossible.

Examination in the Standing Posture.

Sims's (left lateral) position is not adapted for combined examination; but, on the other hand, it sometimes affords a better view of the anterior vaginal wall and portio vaginalis through the speculum.

Sims's Position.

The knee-chest position has no advantage for mere purposes of diagnosis and has become obsolete. It is also one of the most objectionable positions for the patient. It is, however, indispensable when Kelly's methods of examining the bladder are to be employed.

Knee-chest Position.

In cases presenting unusual difficulties Profanter recommends that the combined examination be made in a warm bath. He points out that the folds of the vaginal walls are obliterated by the entrance of the water and that the intra-abdominal pressure and the tension of the abdominal walls are diminished and in part abolished. The woman is placed in a bath-tub filled with warm water, with the sacrum supported on a pillow.

[It is hardly conceivable that such an extreme resort for an examination as this could be of value. In a case requiring such measures it would appear preferable to employ some of the minor anesthetics, such as nitrous oxide gas or ethyl chloride, if a more profound anesthesia were contraindicated.—EDITOR.]

Preparation of the Abdomen. Before attempting combined examination, the corset must be removed and constricting parts of the clothing loosened so that the abdomen shall be free from pressure. A closely fitting corset causes such protrusion and tension of the lower zone of the abdomen that external examination is impossible. At the first examination, when an accurate

Preparation of the Abdomen.

diagnosis is to be made, removal of the corset must be insisted upon, time-consuming though it be; at subsequent examinations it may be dispensed with. In the second place the stomach and intestines should be as nearly empty as possible. If the examination is made during the first hour or two after the principal meal of the day, the results will be unsatisfactory on account of the distended condition of the gastro-intestinal canal, and unpleasant to the patient. Under such circumstances it is better to postpone the examination to the next day. The morning is the best time for an examination, and the intestines, particularly the lower portions, must be neither distended with air nor filled with fecal matter. A full rectum renders accurate examination practically impossible and calls for the administration of an enema or postponement of the examination to the next day. It is not advisable to order the bladder to be emptied before the first examination in every case, because in most patients the urethra, the bladder, and the urine require examination.

Disinfection of the Hand. The wall of the vagina and vaginal portion of the cervix, with which the finger comes in contact during an internal examination, are covered with a thick layer of squamous epithelium, and infection is hardly possible without a solution of continuity in the mucous membrane. The cervix and uterus, on the other hand, are covered with a single layer of columnar epithelium, which is very apt to be rubbed off by the examining finger, freely exposing the absorbent wall. If the uterus contains blood and secretions, the epithelium may be removed by maceration and thus an opportunity afforded for the inoculation of infectious material.

Disinfection of the Hand.

But even if the finger does not come in contact with the abraded surfaces, either produced by examination or already present, it may nevertheless deposit micro-organisms in the secretions of the genitalia and in this way infect the mucous membrane or a previously existing wound. This is particularly true of gonococci. It is, therefore, always desirable that the finger be as nearly as possible free from germs for every examination; but it is quite impossible for a busy practitioner to comply with this requirement. If there is a recent wound in the genital organs, as in the case of abortion; if the uterine cavity is to be explored in the presence of neoplasms that bleed readily, particularly if they are to be operated on later—such as carcinomata, submucous myomata or polypi; and in the case of pregnant women, the most painstaking disinfection is absolutely necessary. For an ordinary examination it is enough to cleanse the hand thoroughly with a brush, soap and water. Thorough disinfection consists in cleansing the hands with brush, soap and water for five minutes, washing in alcohol for one

minute, and in bichlorid of murcury three minutes. A more rapid and safer method is to protect the examining hand with a sterile rubber glove.

It is equally important for the examiner to avoid contact of his finger with the infectious secretions of the patient, particularly when other examinations are to be made immediately afterwards. Infection may be carried from one patient to another in cases of breaking down carcinoma and myoma, gonorrhea or purulent catarrh. Such accidents are best avoided by the systematic use of rubber gloves.

[The custom is becoming more and more prevalent, in this country, to employ rubber gloves or rubber finger-cots in all examinations. Certainly in all cases where there is a malodorous discharge, such as sloughing fibroids, cancer, or abortion, they should invariably be used. By having a number of gloves prepared dry, and well dusted on the inside with talcum powder, examination can be made most expeditiously, and with greater satisfaction to both patient and physician; for the former appreciates the care which is being observed in the examination, while the latter is more certainly using a prophylactic measure for his surgical cases.

Some of the worst operative infections have been attributed to an examination of a septic case, with an ungloved hand, shortly before the operation. As it is a well-recognized fact that effective sterilization of the hands is not possible, it would be best for every physician, and certainly every gynecologist and surgeon, to adopt this plan.—EDITOR.]

If the parts are small and the vaginal walls dry, the finger must be lubricated with a sterile ointment, byrolin or lubricant tubes being most convenient for this purpose. A physician who is in the habit of examining patients at their homes should carry with him two brushes in a box, bichlorid of mercury tablets, and a tube of byrolin or lubricant.

Which Hand?

While it is a matter of indifference **which hand** is used for internal examination, most gynecologists employ the left. The reason probably is that the left hand is the weaker and more delicate and better adapted for touch, while the stronger right hand is better for making pressure from the outside. In this way the individual characteristics of each hand are profitably utilized. In examining a patient at her home the physician is obliged to use whichever hand is convenient under the circumstances, depending on the position of the bed or couch, unless it can be changed so as to permit him to use the hand he prefers. For palpation of the adnexa the hand corresponding to the side to be examined is to be preferred because it can be more readily adapted to the curve of the pelvis. Nevertheless it seems to be better to palpate the right, as well as the left side of the pelvis with the left hand, in order to avoid the introduction of the other hand, particularly as this is quite easily done if the examiner takes his

stand on the patient's left. Although the preference is to be given to one hand in internal examination, the other must nevertheless be sufficiently trained to take its place in case of necessity. The examiner should by all means cultivate ambidexterity.

One or Two Fingers? An examination made with the index finger alone is unquestionably more agreeable to the patient because the introitus is not distended to the same degree as when two fingers are used; but, on the other hand, the result of the examination is much more satisfactory in the latter case. Owing to the extra length of the third (middle) finger, the examiner can feel higher up, and the palpating surface of the fingers also is increased. Another advantage is that, by spreading the two fingers, two different points can be examined at the same time, the dimensions of the body (pelvis) can be estimated and compared, and fluctuation can be determined. For these reasons a diagnosis based on palpation with two fingers is much more certain. I have seen a large number of diagnostic errors occur because only one finger was used. Even in a nullipara two fingers can be used with such gentleness that the woman does not feel them. I use one finger only when the hymen is intact, or the introitus is contracted and painful.

One or Two Fingers?

The **resistance of the abdominal walls** is an obstacle to palpation, to overcome which requires skill and repose on the part of the woman, and endless patience on the part of the physician. In rare cases the resistance is caused by obesity or edema, contraction of the muscles, or extreme tension of the abdominal walls due to large tumors or ascites. Much more frequently the resistance encountered is owing to the patient's inability to relax her abdominal walls from fear and excitement, modesty, or dread of pain, which make it impossible for her to become sufficiently calm. The obstacle is therefore best overcome by reassuring the patient. A quiet, gentle and reassuring manner on the part of the physician tends to quiet the patient, while scolding only makes matters worse; a word of encouragement or praise will allay anxiety. Many women do not know how to relax the abdominal walls, and when they try to do so only add to the rigidity. A good way is to ask the patient to count slowly and regularly, and then to breathe with the mouth open, or to divert her attention by engaging her in conversation.

Resistance of Abdominal Walls.

[A very simple and effective expedient, in the editor's experience, is to ask the patient to sigh deeply. She does this usually without instruction, and if it is repeated, the physician in the meantime commending her efforts by telling her how much she is assisting him, a very satisfactory examination may be made in an otherwise impossible case.—Editor.]

By laying the hand gently on the abdomen and stroking it, the resistance can be overcome in a localized area; or gentle massage may be used until the deeper structures are reached with the palpating hand. At each expiration the external hand should be pressed in a little more deeply, maintaining the ground thus gained during the following inspiration. In this way the hand gradually gets down to the uterus. In spite of every care it will frequently happen that the first examination is without result; the second or third examination, however, will generally prove more successful, and as soon as the woman has gained confidence in the physician and his examination, she will no longer present any difficulties. It is unwise at the first examination to persist under all circumstances until the correct diagnosis has been made. It is much wiser not to frighten and repel the patient by a protracted and painful examination. A general idea of the state of affairs should, of course, always be obtained at the first visit, and malignant disease especially ought to be recognized at once; but aside from that, it is better to make a second examination in a day or two, after the woman's abdomen has been properly prepared. The diagnosis will then be made much more easily, and will often be quite different from the provisional diagnosis. This procedure is particularly to be recommended in complicated cases.

Examination under general (chloroform) anesthesia is an excellent auxiliary procedure in gynecological examinations. Owing to the complete relaxation of the abdomen and the fact that greater pressure can be used, the internal genitalia can be very satisfactorily palpated. We need not be so very conservative with general anesthesia, which is easily induced in women and is usually quite free from danger. In cases of complicated tumors occupying the lower abdomen, particularly, a general anesthetic is almost indispensable if an accurate diagnosis is to be made. If there is any doubt as to whether operation is indicated or not, the diagnosis should always be confirmed by an examination under a general anesthetic, otherwise one may be prepared for many unpleasant surprises at the operating table. Examination under narcosis is of great value in the diagnosis of the seat and character of adhesions in cases of retroflexion, especially when massage is to be employed. Without an anesthetic it is often impossible to determine the extent of a carcinoma in the tissues surrounding the uterus. On the other hand, one must not be too free with chloroform anesthesia; the result that may be expected from the examination must be proportionate to the dangers and unpleasant after-effects, which are inseparable from the administration of a general anesthetic. There is some danger in using too much force in examining under chloroform, as is the tendency

Examination under Anesthesia.

of an inexperienced examiner; inflammations are often made worse in this way, and pus-tubes and extra-uterine gestation-sacs may be ruptured.

[In addition to these dangers two cases have come under the editor's notice in which a too vigorous palpation through the rectum has caused a perforation of this viscus, in one case with a fatal result.—EDITOR.]

By keeping the patient under careful observation and repeating the examination under more favorable circumstances, it is often possible to dispense with an examination under chloroform.

[In this country the use of chloroform is not popular because of its supposed greater danger. Ether is, therefore, in general use as an anesthetic for examinations. The more evanescent anesthetics, such as ethyl chlorid and nitrous oxid, seldom effect a perfect relaxation; besides, the former has had its fatalities. One great and urgent necessity for the employment of an anesthetic is in a young unmarried woman. It is the editor's teaching to employ always an anesthetic under these conditions: first, because it protects the patient against the moral shock of this procedure; and second, and even more important, makes certain an examination. Rarely is even an expert specialist able to ascertain anything of conclusive diagnostic value without this aid. Therefore in young women, when the history strongly indicates the presence of a lesion which may require operative relief, the best end is served when the anesthetic is given with the understanding that, if the suspicion is confirmed, the examination will be followed immediately by the operation. This applies especially in cases of dysmenorrhea in which stenosis or malposition of the uterus are the cause of this symptom.—EDITOR.]

Technique of Combined Examination. The patient is placed in the above-described position, care being taken to see that she does not contract any one group of muscles or hold fast to the table. The two hands should be crossed on the abdomen. The clothing must not be thrown back over the woman's abdomen. The examiner seats himself on the left side of the woman and introduces his left hand into the genitalia under cover of the clothing. If the woman has been placed on the examining-chair, the physician stands between her legs, with his foot on the platform and the elbow of the examining hand resting on his thigh (Fig. 5). The left index finger is then introduced into the vulva—also underneath the clothing—the thumb being used to separate the labia minora, and pressed firmly against the perineum; the crooked middle finger is then slowly introduced into the vagina, avoiding the urinary meatus, which is always sensitive. The hand is then rotated so that the volar surface of the fin-

Technique of Combined Examination.

gers comes in contact with the anterior vaginal wall. The fourth and fifth fingers are either folded into the hand or held under the buttocks, which are slightly raised. In aseptic examinations (see above) the genitalia must be exposed for the introduction of the fingers, just as in the case of a woman in labor. While the conditions within the vagina are being

FIG. 5.—POSITION OF THE EXAMINER AT THE EXAMINING-CHAIR. (Original.)

investigated, the right hand, which must be warm and dry, is slowly placed on the abdomen. Combined examination consists in bringing the genital organs between the external and the internal hand. The structures are slightly elevated by the internal hand so that they can just be reached by the other hand through the abdominal wall. With the internal hand the anterior wall of the vagina is gently elevated; while the external hand, with the finger-tips directed toward the umbilicus,

slowly forces in the abdominal walls and pushes the intestines aside until the genitalia or the internal fingers are felt (Fig. 6).

A certain order should be observed in examining the genitalia:

For reasons already mentioned, inspection of the external genitalia is left to the last, except in case of disease of these structures.

With the fingers that have been introduced into the vagina the conditions in that canal are first investigated. The examiner determines its calibre, the tone of the walls, whether the mucous membrane is smooth and relaxed, and the direction of the canal.

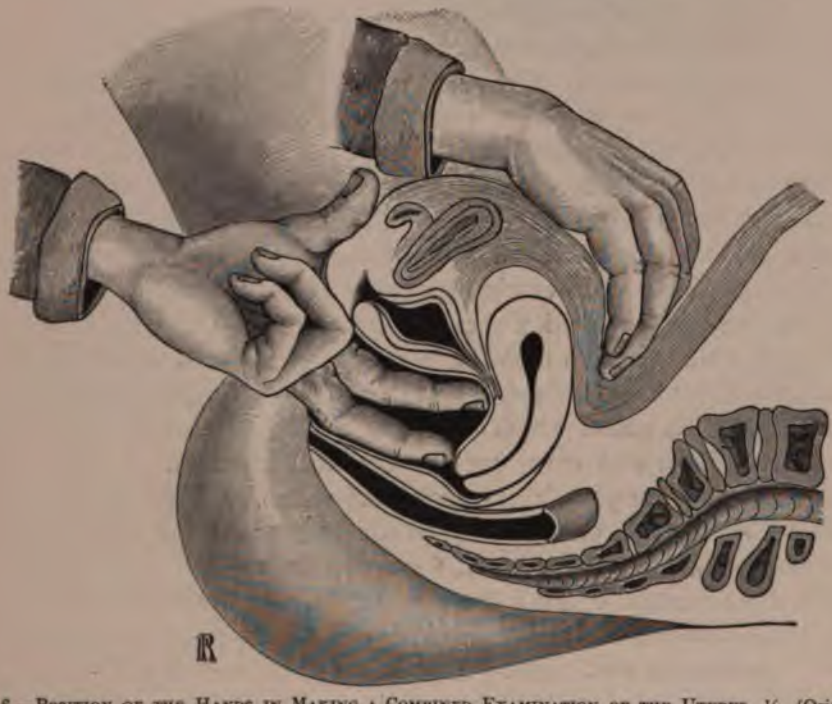


FIG. 6.—POSITION OF THE HANDS IN MAKING A COMBINED EXAMINATION OF THE UTERUS. ⅓. (Original.)

The tips of the fingers are then carried up to the vaginal portion, where the following points are investigated: The position of the vaginal portion, both in the vertical and the lateral plane, its shape and form, the character of the external os, the consistency of the tissues and degree of relaxation of the mucous membrane, and the degree of movability in all directions. Finally, the vaginal vault is palpated to determine whether its curvature is normal, or whether it is flattened or pushed down by tumors from above.

While these points are ascertained with the internal fingers, the external hand is placed on the abdomen and the combined examination begun. First the uterus itself; then the left adnexa (ovary, tube,

and parametrium), and, finally, the same structures on the right side of the organ are examined. (For details see pages 85, 88, 90, 91.)

With regard to the external genitalia, the examiner determines chiefly the shape and form of the labia majora and minora, the width of the vulva and character of the perineum, and the presence of inflammation, eruptions, ulcerations, or neoplasms of the external skin. The labia are then separated, exposing the vestibule and introitus vaginæ for the purpose of inspecting the external orifice of the urethra, the clitoris, hymen, Bartholin's glands, the mucous membrane of the vestibule and of the vagina, and any secretions or blood that may be present on the external genital organs.

The combined examination should be made as painless as possible; hence, in introducing the fingers, the examiner must be careful not to drag in the pubic hairs, and to avoid any rough handling of the anterior commissure and urinary meatus, which are always sensitive. The fingers should not remain too long in contact with the introitus, and especially the clitoris, as this often causes sexual excitement. The movements of the internal fingers must be made slowly and very gently. Gentle pressure only must be employed in indenting the abdominal walls with the outer hand, as excessive or sudden pressure is painful and at once causes contraction of the abdominal muscles, which interferes with the examination. Even greater caution is necessary in examining inflamed organs: rough handling of such parts, which are often exceedingly painful, makes the patient rebellious and may increase the inflammation. If the woman experiences a severe pain during the examination, all hope of quieting her for that visit is at an end. Patience and forbearance on the part of the examiner bring their own reward, for a woman is quick to recognize and esteem these qualities. In spite of all this, the examination must be completed in as short a time as possible, and to satisfy both these requirements—gentleness and speed—demands much practice and experience. A beginner will do better, if the woman's patience has been exhausted, to interrupt the examination and repeat it under more favorable conditions.

Rectal Examination.

Examination through the rectum becomes necessary when the introitus is closed, or greatly contracted by a hymen, or so painful on account of catarrh and vaginismus that the finger cannot be introduced.

Rectal Examination.

Palpation through the soft and yielding rectal wall gives a much more positive result also when the vaginal wall is tense and rigid and resists the necessary degree of invagination. Examination through the rectum is particularly useful in all cases of disease in the posterior portion of the parametrium, the folds of Douglas, Douglas' space and the recto-vaginal septum. It is urgently recommended for

the diagnosis of carcinomatous and inflammatory thickening of the parametrium, in the presence of exudates, hematomata or tumors in Douglas' space, and of alterations in the posterior uterine wall. One finger is enough in cases of disease in the neighborhood of the lower portion of the rectum; but in the presence of tumors seated at the level of the cervix and higher, it is necessary to introduce two fingers into the rectum, which can be done only under general anesthesia. The introduction of the entire hand into the rectum, as recommended by Simon, is unnecessary and has been given up on account of the danger it involves. In examining through the rectum it is best always to intro-

FIG. 7.—POSITION OF THE HAND IN MAKING A COMBINED RECTO-VAGINAL EXAMINATION. ⅕. (Original.)

duce the thumb into the vagina at the same time; in this way tumors felt through the rectum can be controlled and their topography determined with greater accuracy; at the same time a combined examination can be made of the posterior portions of the parametrium and of the recto-vaginal septum (Fig. 7).

The rectum must be emptied before attempting a combined recto-vaginal examination. One or, if necessary, both fingers are then introduced with great care so as not to produce a fissure; the two walls of the gut which are in apposition are separated, and the fingers are carried up through the fold of Kohlrausch to the level of the cervix and pelvic connective tissue. If any difficulty is experienced in finding the entrance

to the upper portion of the rectum, the gut should be moderately filled with water (Sellheim). It is not necessary to disinfect the hand for a rectal examination, but in order to protect one's fingers from pollution a rubber finger-cot should always be worn. The finger should never be carried directly from the vagina into the rectum, on account of the danger of transferring micro-organisms, especially gonococci, in this way; disinfection or the use of a glove is necessary in cases of this kind.

Examination of the Genitalia through the Bladder is necessary only in very exceptional cases in order to determine the position of the bladder in relation to tumors and exudates in the anterior parametrium or preperitoneal cavity in immediate contact with the viscus, and especially when operative interference is contemplated. Before doing so, one should try to obtain the necessary information by introducing a male catheter. If the results are still uncertain, the finger must be introduced. For this purpose the urethra must be dilated.

Examination of the Genitalia through the Bladder.

Simon's urethral specula or Hegar's dilators, from the thickness of a catheter to that of a finger, are employed. The instruments are sterilized by boiling, and slowly and cautiously introduced. Successive sizes are used until the necessary dilation has been secured, the finger being introduced immediately after the largest instrument has been withdrawn. If resistance is encountered at the external orifice of the urethra, it must be divided on both sides a distance of about 0.5 cm. After the examination has been completed, the bladder and urethra are irrigated with a 3-per-cent. boric acid solution, and the incisions or lacerations at the meatus closed with sutures. The palpating finger must be carefully disinfected, because dilatation is always attended with slight lacerations.

Technique of Urethral Dilatation.

By means of examination of the bladder with the cystoscope displacements and alterations of the vesical wall, caused by tumors in close apposition, can be very satisfactorily determined, and the development of cystoscopy practically enables us to dispense with palpation of the bladder for this purpose almost entirely.

Method of Using Specula.

Specula are used to separate the vaginal walls, and thus make possible direct inspection of the vagina, the vaginal portion of the lower segment and the cervical canal. They are employed for the purpose of recognizing changes limited to the surface of these parts, such as discoloration of the mucous membrane during pregnancy, catarrh, superficial ulcerations of the vaginal portion, erosions and beginning carcinoma; hence they are not needed in every gynecologic examina-

tion, but only when it is desired to study changes in the mucous membrane which cannot be certainly recognized by palpation.

Gynecologists use two kinds of specula:

Fig. 8.—Ground-glass Speculum of Carl Mayer. (Original.)

Fig. 9.—Four Ground-glass Specula of Different Sizes. (Original.)

1. **The Ground-Glass Speculum Designed by Carl Mayer.** The speculum must be perfectly cylindrical and the glass must not be too thick, so that the examiner may see as much as possible when the vagina

Fig. 10.—Introduction of the Ground-glass Speculum. (Original.)

is distended. It must not be too long, and the upper end must be bevelled so as to bring the vaginal portion well into view when the tube is rotated; the anterior border is rolled (Fig. 8). Four sizes are usually employed, the diameters of which are about 4, 3, 2.5, and 1.5 cm., respectively (Fig. 9). No. 2 is generally used for multiparæ, and No. 3 for nulliparous women. The technique is as

Ground-glass Speculum.

follows: The labia majora are separated with the index and middle fingers and the left hand applied to the internal surface of the labia so as to expose the introitus. The speculum, previously lubricated with vaseline or byrolin, is held in the right hand with the anterior opening toward the palm, and the index finger applied to the upper surface of the speculum near the bevelled edge. The instrument is placed flat against the perineum so that the opening is at the level of the introitus (Fig. 10), and strong pressure is made on the perineum while it is slipped into place. Contact with the urinary meatus must be avoided. If the introitus is narrow, and when there is vulvitis or vaginismus, the introduction of the specu-

FIG. 11.—SIMON'S SPECULUM (posterior blade). ⅓. (Original).

FIG. 12.—SIMON'S SPECULUM (anterior blade). ⅓. (Original.)

FIG. 13.—SIMS' SPECULUM.

lum may be very painful and occasionally attended with the production of minute tears of the mucous membrane. After the speculum has been introduced into the vagina it is at once carried up to the vaginal portion, the anterior lip of which first enters the bevelled end of the speculum, while the external os and the posterior lip remain hidden behind it. A beginner thus gets the impression that he is dealing with hypertrophy of the anterior lip, but by depressing the speculum a view of the posterior lip also can be obtained. When the cervix is adherent posteriorly or laterally to the pelvic wall, it is often difficult to find the vaginal portion. In such a case we follow the lumen of the vagina until some part of the portio vaginalis is dis-

covered, being recognized by the smooth character of the mucous membrane; the speculum is then strongly depressed and a view of the external os is obtained. One must be careful not to push the speculum too far up, because by doing so the vaginal vault is displaced upward and the separation of the labia produces an artificial ectropion; by slightly withdrawing the speculum the vaginal portion can usually be brought into view without difficulty. As the examiner withdraws the speculum, he alternately raises and depresses the tube in order to get

Fig. 14.—Method of Introducing the Posterior Blade of Simon's or Sims' Speculum. (Original.)

a good view of the lateral walls as far back as the introitus. Accurate inspection of the vaginal portion with the ground-glass speculum is sometimes difficult because the cervix is displaced too far upward with this instrument and does not receive sufficient illumination. It is therefore better to examine with Simon's speculum. The ground-glass speculum is very useful in daily practice, because it can be used without an assistant, and a variety of therapeutic procedures can be carried out with its use.

2. **Simon's or Sims' Speculum** consists of two blades attached to handles and is employed for the purpose of separating the two vaginal

walls. The view obtained with a Simon or Sims speculum is much more satisfactory; the examiner sees the vaginal portion, the entire vaginal vault, and the lateral walls of the vagina. The vaginal portion, when the uterus is movable, comes well down between the two blades and can be readily studied under good illumination, or drawn down with a double tenaculum for a more careful

Simon's Speculum.

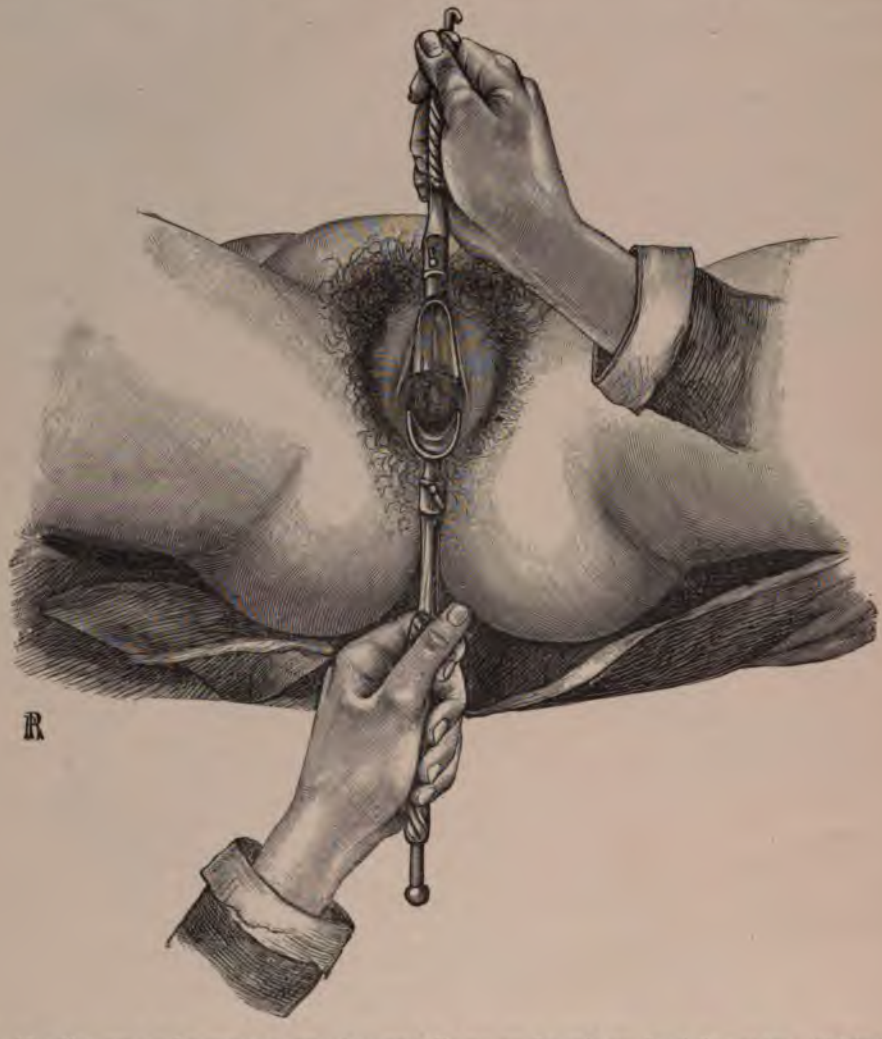


FIG. 15.—METHOD OF INTRODUCING THE ANTERIOR BLADE OF SIMON'S OR SIMS' SPECULUM. (Original.)

inspection. It is only when the cervix is fixed that inspection is difficult, even with Simon's or Sims' speculum. The only obstacle to its more general employment is that an assistant is required when the examiner needs a free hand for sponging the vaginal portions, or other manipulations.

Simon's speculum consists of two blades, one concave for the posterior (Fig. 11), and one flat for the anterior wall (Fig. 12). A stock of several sizes is necessary. (It is important to see that the narrower blades are not made shorter, as instrument makers are very apt to do.) The blades are attached to handles, a straight one for the posterior blade and a curved handle for the anterior, to correspond with the prominence of the symphysis.

Fig. 16.—Bivalve Speculum.

The examiner seats himself between the woman's legs, in front of the examining-chair, and separates the introitus with two fingers of the left hand. The posterior blade is then taken in the right hand and allowed to glide slowly into the vagina (Fig. 14). The handle is then transferred to the left hand, and the perineum forcibly depressed so that the vulva gapes; the handle of the anterior blade is then taken in the right hand, placed on the abdomen, and the blade allowed to enter immediately below the urinary meatus and as far away as possible from the posterior blade (Fig. 15). The two blades must not be brought too close together, in order to avoid catching folds of mucous membrane between them. In removing the specula, which is accomplished in the inverse order, special care is necessary to keep the blades well apart. The specula must be boiled every time they are used.

[The specula most commonly used in the United States are the **trivalve** and **bivalve.** The trivalve is of especial value, for with slight dexterity it may be made to serve almost every end in an ordinary examination. By introducing it collapsed well up to the cervix, then gently spreading its blades with a set screw, and gently manipulating it, the cervix may be brought into perfect view. After completing the inspection, the instrument is gradually withdrawn with open blades until the outlet is reached, when it is again collapsed and withdrawn without pain. As it is withdrawn, all parts of the vaginal tract may be inspected. It serves all purposes so well that it or the bivalve speculum has very largely supplanted Ferguson's, Simon's, and Sims' specula for ordinary office use. For examination when the patient is under an anesthetic, the latter instruments are more

Fig. 17.—Trivalve Speculum.

generally in vogue. In the editor's experience, the bivalve or trivalve speculum suffices for all forms of gynecologic local treatment.—EDITOR.]

The Uterine Sound.

The uterine sound (Fig. 18) is a probe-like instrument about 30 cm. in length, with a broad handle, and marked with ridges on the upper side to enable the examiner to recognize the position of the sound in the uterus. The tip is armed with a knob-like enlargement about 2 to 3 mm. thick, in order to avoid injuring the uterine wall. The convex side is graduated by means of shallow incisions in centimeters, and 7 cm. from the knob is a ring the distance of which from the external orifice readily enables the examiner to determine whether the sound is in the uterine cavity or only in the cervix. The sound must be made of flexible metal so that it can be bent to correspond to any curve of the uterus.

FIG. 18.—UTERINE SOUND. ½. (Original.)

Sounding of the uterus must be performed with the strictest aseptic precautions. The instrument must be boiled before it is used in order to avoid the introduction of germs from the vagina into the uterine cavity, which is ordinarily sterile. While the micro-organisms which inhabit the vagina and cervix are harmless to living tissue, they may, in the presence of traumatisms and material capable of decomposition, readily produce infection.

The technique of the introduction of a sound must therefore be such as to preclude the entrance of vaginal germs into the uterus. This is best accomplished by exposing the external os with the speculum. For this purpose the simplest is the cylindrical, ground-glass speculum [or, as indicated above, the bivalve or trivalve speculum.—ED.], as the examiner can hold it himself while introducing the sound; whereas a speculum of Simon's type requires an assistant. Disinfection of the vagina is not absolutely necessary. The vaginal portion is brought into the speculum and its surface, particularly the external os, carefully cleansed with a cotton pledget saturated in a 1:1000 solution of bichlorid. The sound is then taken in the right hand and introduced into the cervical canal until it meets with resistance. Holding the sound in this position with one hand, the cylindrical speculum is then withdrawn over the sound with the other, leaving one hand free (usually the left) two fingers of which are applied to the external os. The handle is then depressed, and the sound

Technique.

gradually pushed farther into the uterus until it passes the internal os and enters the uterine cavity. This is attended by an elevation of the uterus through 20 to 30 degrees; hence sounding requires a certain degree of mobility of the organ. Quite frequently the sound catches in the folds of the cervical mucous membrane or on the internal os; this may sometimes be overcome by using a thicker sound. The universal remedy, however, when difficulties are encountered in the cervical canal, consists in drawing the vaginal portion forward with the double tenaculum. This smooths out the folds in the mucous membrane and obliterates the angle at the internal os, so that the sound readily enters the uterine cavity. The double tenaculum may be held with the little finger of the left hand so as to dispense with the services of an assistant.

In abnormal positions of the uterus the technique of introducing the sound is somewhat different. In acute-angled anteflexion a sharp curve must be given to the sound, and the vaginal portion drawn forward with the double tenaculum. In retroversion of the uterus introduction of the sound is attended with the least difficulty because the vagina, cervical canal and uterine cavity form a straight line; the sound is introduced without depressing the handle. In retroflexion of the uterus the sound is introduced in the ordinary manner into the cervical canal; it is then rotated so that the concavity is directed posteriorly, and allowed to glide into the uterine cavity by elevating the handle. For this reason the position of the uterus must always be accurately determined before using the sound. The most important requisite for successful sounding is a light and steady hand. The channel through which the sound is to make its way must be found solely by the employment of skill, without using any force whatever.

The contraindications to the use of the sound are:

1. Pregnancy. The introduction of the sound into the gravid uterus often causes injuries of the ovum and abortion. It is true that during the first months the sound often enters between the ovum and the uterine wall, and no abortion results because the irritation of the sound is not sufficient to produce labor pains; but if the ovum completely fills the uterus, the procedure is almost invariably attended with injury to the ovum, which in most cases is followed by abortion. The best way to avoid sounding a gravid uterus is to determine beforehand whether the woman is pregnant; or, a still safer rule is always to inquire about the last menstruation before introducing a uterine sound. The conditions which are most likely to lead to the introduction of a sound into a gravid uterus are the occurrence of pregnancy in a woman while she is under gynecologic treatment, and the occurrence of pregnancy under conditions which render it extremely unlikely, such, for example, as marked degrees of prolapse. It follows

Contra-indications.

therefore that the use of the sound for the purpose of making the diagnosis of pregnancy is not justifiable. If the physician has been so unfortunate as to sound a gravid uterus, the woman should be put to bed for a few days, and several doses of opium administered in order to prevent abortion.

2. Acute infection in the neighborhood of the uterus. As the introduction of the uterine sound is always attended with a forward movement of the cervix and elevation of the uterine body, it necessarily exerts traction on exudates connected with these structures. In this way we often see exacerbations of parametritis and perimetritis and the occurrence of recent peritonitis in tubal disease. In the presence of hematocele and recent tubal pregnancy sounding should always be avoided, because traction on such structures may produce fresh hemorrhage and sometimes cause necrotic decomposition. In chronic inflammations not attended with much pain the cautious use of the sound is permissible. For these reasons the tissues surrounding the uterus must be subjected to careful examination before resorting to the use of a uterine sound.

3. Virulent catarrh. Sounding the uterus is not permissible under these circumstances because carriers of infection, especially gonococci, are thereby introduced into the uterine cavity; or, if the uterine cavity is already diseased, into the tubal orifices; hence the introduction of the sound and intra-uterine manipulations generally occupy an important place in the etiology of gonorrheal pus-tubes. As a positive diagnosis of virulent catarrh cannot always be made, it is wise to avoid the use of the sound in the presence of any purulent or suspicious discharge.

There are other cases in which the use of this instrument is not without danger. It may produce an infection, not so much through germs attached to the sound itself, as from the fact that in spite of every care organisms may be introduced with it from the vagina into the uterine cavity and inoculated into minute wounds of the mucous membrane; hence the greatest care is necessary to avoid any traumatism of the mucous membrane, and if the procedure is followed by bleeding, it is better to disinfect the uterus. The accident that is dreaded more than any other is perforation of the uterus. A slight injury of the mucous membrane is by no means uncommon even under the greatest care, but the substance of the uterus, if the consistency of the organ is normal, practically always resists the entrance of the sound. If the muscle is softened by fatty degeneration during the puerperium, or the presence of malignant growths; if the uterus is atrophied; or if, in the presence of a myoma, one wall of the uterus is greatly attenuated, very slight pressure often suffices to perforate the uterine wall. Under such circumstances

Dangers Incident to the Use of the Sound.

the sound must be introduced very slowly. As soon as the examiner feels that the sound is entering the parenchyma he must withdraw it at once. Unfortunately the instrument often passes through the wall without the examiner's feeling the slightest resistance, and disappears into the vagina up to the handle. Perforation of the uterus with the sound is almost always unattended by danger; if, however, the viscus contains decomposed material, the accident may be followed by peritonitis. If perforation occurs, the woman must be kept quiet for a few days and treated with small doses of opium.—Hemorrhage of considerable severity not infrequently occurs during the introduction of the uterine sound. It is most likely to occur in cases of proliferative endometritis, carcinoma, or subinvolution of the uterus. The hemorrhage may be attended with danger when the uterus contains the remains of an abortion or placental masses of considerable quantity. Even when the instrument was used with great care, I have often seen profuse hemorrhage in these cases, requiring for its complete arrest the packing of the cervix or closure of the external os with sutures. For this reason the introduction of the sound should be avoided when there is reason to suspect that the uterus may contain large remnants of an abortion or placental tissue.

It is evident from what has been said that sounding the uterus is by no means a simple operation, and it should therefore be used as rarely as possible. It is not a necessary part of every gynecologic examination, and should be employed only in the presence of a definite indication and when the desired result cannot be obtained without its use.

The greater the examiner's skill in palpation, the less will be the need of using the sound; it is required chiefly for investigating the state of the uterine cavity. [One might say, as a corollary, the less the examiner's skill, the greater the danger from the use of the sound, and the less information its employment will afford. Therefore it should only be used by the skilled examiner.—Editor.] By means of the sound we first determine the width of the cavity, and this gives us some clue to the degree of relaxation of the uterus or distention of the cavity by abnormal contents. Normally the excursion of the tip of the sound in the uterine cavity, when the handle is rotated, is limited; but if the cavity is dilated, the sound can readily be moved in all directions and rotated around its longitudinal axis. Abnormal contraction of the uterine cavity is recognized by the fact that the movements of the sound are extremely limited. The palpation of intra-uterine tumors is much more difficult than one would suppose. Soft polypi with slender pedicles readily avoid

Indications for the Use of the Uterine Sound.

the sound and escape the examiner's notice. Submucous myomata of firm consistency and broad base are somewhat more easily recognized, and give the impression of a prominence of the internal uterine wall; but even large solid tumors which completely fill the uterine cavity are not always recognized with the sound, as I have frequently had occasion to observe; hence too much reliance should not be placed on the results of sounding in this respect, and if polypi are suspected, the cervical canal should be dilated and the uterine cavity explored with the finger. The information with regard to the condition of the endometrium which is gained by examination with the sound is, on the other hand, quite positive. In fact, irregularities of the surface are felt much better with the sound than with the finger, and the detection of such irregularities is one of the chief uses of the instrument. Normally the endometrium feels smooth, or at most presents a few inequalities of the surface at the fundus. In carrying the sound from one cornu to the other, the centre of the fundus is not infrequently felt as a prominent ridge. If distinct irregularities are discovered, they are usually pathological. They are felt in carcinomatous changes of the mucous membrane, in chronic fungous endometritis, and retention of small portions of decidua after abortion. The detection of these irregularities requires some skill in handling the instrument. With the internal fingers applied to the vaginal portion, the sound is carried to the fundus, rotated in various directions with some pressure, or allowed to glide along the uterine walls and angles of the uterus, at the same time moving the instrument in various directions. In order to be positive that inequalities and rough places are present, the tip of the sound must be held firmly against the wall. The variety of hypertrophy cannot be positively determined by the nature of the inequalities. The presence of pain in the endometrium, and its degree, can also be tested with the sound. With a healthy endometrium careful sounding is painless except in the case of sensitive nervous women, who frequently complain of pain as the sound passes the internal os. If, in a woman whose resistance is good, contact of the sound with the endometrium is painful or even produces spastic conditions of the uterus, the existence of inflammation may be suspected. It is sometimes very difficult to distinguish perimetritic or parametritic from endometritic pain. Perimetritic pain is elicited if the sound in passing the cervix pushes it forward and causes traction on inflammatory bands behind the uterus; or if the uterine body, which tends to straighten up as the sound enters the cavity, pulls on adhesions situated in front. One is not justified in diagnosing endometritic sensitiveness except when the uterus is completely movable, and careful touching of the endometrium, without producing any dislocation of the uterus, elicits pain. It usually

takes the form of a cramp-like pain in the lower abdominal or umbilical region. In examining the uterine cavity for inequalities or painful points, it is well to follow a certain system: beginning first at the fundus, then passing the sound over the anterior and posterior walls, and finally in parallel lines over the angles and orifices. By means of the sound we also determine occlusions or stenosis in the cervix and in the body cavity. A normal orifice readily admits the tip of a sound measuring from 2 to 3 mm. in thickness. The mere resistance to the introduction of the sound must not, however, be regarded as a sign of stenosis, for an inexperienced examiner is apt to catch the sound in folds of the cervix. If, however, the sound is readily arrested at the same point while the cervix is drawn down with the tenaculum, or if the examiner receives the impression that the sound passes with difficulty a certain point, the presence of a stenosis may be suspected. Stenosis in the uterine cavity is much more rare and also gives the impression of an obstacle to the advance of the sound.

Finally, the introduction of the sound is useful as affording a means of confirming the diagnosis of uterine diseases which lead to shortening, lengthening or displacements of the organ. In general these conditions are detected by palpation, but the results of palpation are not always as positive as one might wish. In such a case the findings may be supplemented by means of the uterine sound. In the first place the instrument may be used to find the uterus, if it cannot be felt on account of the thickness of the abdominal walls, or if the organ is hidden between tumors and cannot be palpated on that account. The sound is introduced, and by noting the direction which it takes the position of the uterus may be inferred; or the tip of the sound within the uterine cavity may be located through the abdominal wall and thus the position of the fundus determined directly. In these cases special care is necessary in handling the sound because the direction of the uterine cavity is not known, and the danger of injuring the wall is therefore increased.

Case 1. In looking for the uterus in a case of intraligamentary cystic tumor, I once had the ill luck to perforate the attenuated wall of the viscus and pass the sound into the tumor.

There is no doubt that in the great majority of cases in which the sound is employed, it is introduced for the purpose of measuring the uterine cavity and in that way determining the size of the uterus. By means of careful palpation, diminution or enlargement of the uterus can be recognized without difficulty, but owing to the variable thickness of the wall the interpretation of our findings is often quite unreliable. A comparison of the results of palpation with the measurement obtained with the sound often offers the best means of determining

the length of the uterus and the thickness of its walls. This method is employed particularly in the case of myomata, in chronic metritis and in atrophic conditions. The thickness of the uterine wall can readily be determined by palpating the sound as it lies in the uterus through the abdominal wall. In this way small myomata in the uterine wall can readily be recognized. In rare cases the use of the sound is justified for the purpose of detecting adhesions around a retroflexed uterus. The sound is introduced into the retroflexed uterus, turned on its axis, and the handle depressed for the purpose of elevating the uterus. If the organ is movable it readily follows the movement of the sound. In the presence of adhesions an inelastic resistance is encountered, and the procedure causes pain. This method also is employed only when palpation has failed to give results.

The information obtained by means of the sound usually has to do with the finer points in the diagnosis, such as are expected only from a specialist; hence the ordinary practitioner very rarely has occasion to use the sound, and he should never resort to its use merely for the purpose of supplementing the results of palpation when these have proved inadequate.

[The author has very fully warned against the employment of this instrument. It carries with its use so much danger that it should only be employed by an expert, and even he would be severely censured by his colleagues should an accidental infection occur. The rule, therefore, may well be laid down, that a sound is only to be used in cases of the very gravest doubt and then only under the most extreme precaution. The editor has so frequently seen such serious results follow the careless introduction of a sound that he believes it should be only an instrument of an expert's armamentarium.—EDITOR.]

Dilatation and Palpation of the Interior of the Uterus.

We have several methods at our command for the diagnosis of intra-uterine diseases,—sounding of the uterine cavity, the microscopic examination of tissue obtained by curettage, and palpation of the interior of the uterus with the finger. There is no doubt that the sense of touch is most delicate with the sound, and inequalities and roughness of the uterine wall can be detected without difficulty by its aid. The finger is best adapted for recognizing circumscribed gross changes, such as polypi, myomata, or carcinomatous infiltration; while the microscope enables us to recognize with certainty the histologic changes due to superficial disease processes. A cancer of the body of the uterus can at best only be suspected when marked irregularities in the uterus are felt with the sound. The diagnosis becomes certain only when particles of the proliferated tissue, removed with the curette, are exam-

ined under the microscope and the histologic structure of carcinoma is demonstrated; but cancer of the body as well as cancer of the cervix may be diagnosed with equal certainty if the finger is introduced and infiltration or ulceration is felt in the wall of the body. In the case of sarcomata and polypi the diagnosis is arrived at in a similar manner. The two methods, internal palpation of the uterus and microscopic diagnosis, are, therefore, in a certain sense consonant procedures. The same end may be reached by either, and the choice between the two will frequently depend on the physician's personal preference. Aside from the fact that dilatation of the cervix followed by internal palpation of the uterus is unquestionably more dangerous than exploratory curettage, it must be emphasized that the use of the microscope is unquestionably superior to internal palpation of the uterine body, because there are many sources of error when the latter procedure is employed. In the first place, the constriction exerted by the cervix on the finger impairs its sense of touch, and its movements are so restricted within the narrow uterine cavity that the results of palpation are much less positive. But even aside from these external difficulties, the sensation of touch is not sufficiently delicate to detect cancer of the mucous membrane in its earliest stages, before the process has gone on to infiltration and distinct ulceration; whereas microscopic examination yields a positive result even at this stage. Again, it is very difficult to distinguish between sarcomatous and benign uterine polyps by the sense of touch alone. The attempt to diagnose malignant disease of the uterus by means of the palpating finger alone is associated with so many sources of error that mistakes are bound to occur very frequently. Microscopic diagnosis also has its limitations. It may happen that the curette does not bring away any of the diseased tissue, although this is rare; a circumscribed neoplasm may begin to develop at a point in the uterine cavity which is difficult of access; or the histologic picture may not be sufficiently clear. For these reasons it must be conceded that both methods have their value, although microscopic diagnosis is by far the most important. The procedure to be adopted in the case of hemorrhage should be as follows: First, the uterine sound is employed, and if inequalities are discovered, the uterus is curetted and the scrapings subjected to a microscopic examination. If this also fails to give the desired result, the examiner should proceed to palpate the interior of the uterus.

Case 2. In 1895 I performed a curettage on an elderly woman on account of profuse hemorrhage. The microscope revealed a few areas that were suspicious of sarcoma, but no positive diagnosis could be made. I therefore dilated the cervix, palpated the interior of the uterus, and discovered a polypoid neoplasm which I regarded as a sarcoma. After extirpation of the uterus, the growth was found to be a simple mucous polyp.

The indications for dilatation and internal palpation of the uterus are therefore as follows:

1. Great discrepancy between the clinical symptoms and the microscopic findings. If, for example, in an old woman, the presence of a malignant neoplasm is suspected on account of persistent hemorrhage, and repeated microscopic examinations of scrapings fail to reveal anything but benign disease, so that no positive conclusion can be arrived at, the interior of the uterus should be explored. Internal palpation of the uterus, in such cases as this, is accordingly employed for the purpose of controlling or supplementing the microscopic diagnosis.

Indications.

2. When in a case of repeated uterine hemorrhage, after the alterations have been positively shown to be benign by microscopic examination, there is strong reason to suspect a cause for the hemorrhage, such as a polyp or a submucous myoma. In cases of this kind internal palpation is employed for the purpose of supplementing examination with the sound, which in the case of circumscribed polyps usually yields very uncertain results.

A prerequisite for internal palpation of the uterus is that the cervix be sufficiently dilated to admit one finger. Spontaneous dilatation takes place when polyps, polypoid myomata, sarcomata, or carcinomata are expelled. Quite frequently, however, the external os, in nulliparous women especially, offers prolonged resistance and has to be dilated in order to permit palpation.

Dilatation of the External Os.

Dilatation of the external os is effected by dividing the vaginal portion on both sides. Under anesthesia, and after careful disinfection of the external genitalia and the vagina, the vaginal portion is brought into view with a Simon or Sims speculum, the anterior and posterior lips are grasped with a Muzeux forceps, and the vaginal portion divided on both sides as far as the vaginal vault. A sufficient view of the dilated cervical canal is thus provided, the finger may be introduced for the purpose of palpation, and in many cases extirpation of the polyp may be done at once. The two incisions are then closed with interrupted catgut sutures, and the vagina is lightly packed with iodoformized gauze. The technique of the procedure is not difficult; it rarely fails, and may be recommended even to practitioners without special skill.

Dilatation of the Cervical Canal.

In most cases the entire cervical canal offers an obstacle to internal palpation of the uterus. Incision of the entire cervix, either with bilateral incisions or by a median incision after pushing up the bladder, which has been recommended for the purpose of dilatation, is too severe a procedure for diagnostic purposes. For routine practice the following methods are recommended:

1. **Instrumental Dilatation.** Hegar's dilators, which are made of metal, hard rubber, and glass, are the best instruments for the purpose. Metal dilators are the best, because most durable; a series ranging in thickness from the size of a sound to that of the finger is required (Fig. 19). After painstaking disinfection of the vulva, vagina and lower portion of the cervix, the vaginal portion is brought into view with a Simon or Sims speculum, drawn down with a hook, and successive numbers, beginning with the proper thickness, are then introduced one after the other. Even if the introduction is performed very slowly, and each number is left in place for several minutes, the dilating force of the instrument is so great that the cervical tissue may be ruptured. In dilating a closed cervix sufficiently to admit the finger, a more or less extensive laceration is almost certain to occur even when the tissues are soft and yielding. Hence this method of dilatation should be employed for purely diagnostic purposes only when the cervix is already in process of spontaneous dilatation, or for completing a dilatation begun with laminaria tents, when that method has proved inadequate.

Dilators.

FIG. 19.—HEGAR'S HARD-RUBBER DILATORS. ⅓. (Original.)

FIGS. 20 AND 21.—METAL DILATORS. After Schröder and Landau. (Original.)

Dilatation of the cervix, such as is required for the purpose of exploratory curettage, is effected by the introduction of thin metal dilators like those designed by Schröder (Fig. 20) and Landau (Fig. 21). The dilatation is begun with a number approximately corresponding to a thick uterine sound, and gradually increased by the introduction of dilators of increasing thickness up to that of a moderately broad uterine curette. This method of dilatation should also be performed with a Simon or Sims speculum.

2. Of all the contrivances at our disposal **laminaria tents** are the most reliable, and at the same time the least injurious. They satisfy better than any others the requirements of safe dilatation; that is to say, slow but sure, provided the antisepsis is adequate.

Laminaria Tents.

Laminaria tents act by absorbing the secretions of the uterus until they swell up and forcibly distend the cervix; at the same time they tend to increase the blood supply of the cervical tissue, so that it

becomes soft and more susceptible of distention; besides, they induce labor pains, the effect of which is also to dilate the cervix. Laminaria tents (stems of sea-tangle, *Laminaria digitata*) must be perforated in their long axis and armed with a thread, which is carried through the cervical canal and permits the removal of the tent (Fig. 22). It is not advisable to pass the thread through a hole in the lower end of the tent, because it is apt to tear out and leave the tent behind in the uterine cavity.

CASE 3. I once had a case in which the thread tore out and the tent disappeared behind the external os, and I had great difficulty in extracting it.

FIG. 22.—LAMINARIA TENT ARMED WITH A SILK LIGATURE. ⅓. (Original.)

The following methods are recommended for the disinfection of laminaria tents:

1. The tents are placed, for some time before they are to be used, in a solution of iodoform in ether with an excess of iodoform. When the tents are removed, the ether evaporates and they remain covered with a thin layer of iodoform.

2. The tents may be immersed one by one for twenty seconds in boiling water, and kept in a one-per-cent. alcoholic solution of bichlorid of mercury.

Before introducing the laminaria tents, the external genitalia and the vagina must be carefully disinfected. The surest way to prevent the entrance of organisms is to introduce the tents with the aid of a Simon or Sims speculum, thus avoiding contact with the vaginal walls. The vaginal portion is grasped with a hook and the cervical canal wiped out two or three times with a Playfair probe dipped in bichlorid solution. After again determining the direction of the uterus with the sound, the cervix is dilated with metal dilators up to 6 or 7 millimeters. The advantage of this preliminary procedure is that a laminaria tent of 6 or 7 mm. in diameter can then be introduced, and this may be depended upon with certainty to dilate the cervix sufficiently for the introduction of one finger. The laminaria tent is then carefully introduced with a dressing forceps until it almost touches the fundus. If the vaginal portion is drawn well down, it is usually unnecessary to bend the tent so as to conform to the curve of the uterine cavity. A little iodoform gauze is then packed in front of the tent in order to prevent its slipping out again. The woman must be kept in bed, and the temperature taken every three hours; when 38.5° C. has been reached, the tent must be removed and the uterus disinfected. Twenty-four hours later the vulva and vagina are once more disinfected and the tent is removed by pulling on the thread. If the tent fails to come

away, or threatens to break up, it must be seized with a strong cervical forceps and removed with slow rotating movements. The pain induced by this procedure, which is due to the downward pull on the uterus, can be mitigated by pushing both vaginal walls upward with the edges of the speculum. After the uterus has been carefully irrigated with a disinfecting solution, the examiner satisfies himself that the cervix admits one finger. If it does not, he proceeds to dilate with the corresponding numbers of Hegar dilators (usually up to 20). He is then ready to begin palpation, which usually has to be performed under

FIG. 23.—POSITION OF THE HANDS IN EXPLORATION OF THE UTERINE CAVITY. ⅕. (Original.)

anesthesia. Two fingers are introduced into the vagina, the index finger is strongly flexed and the middle finger, being the longest, is allowed to enter the uterine cavity through the dilated cervix.

[In the digital examination of the uterine cavity, either a sterilized rubber finger-cot or rubber gloves should invariably be worn.—EDITOR.]

At the same time the examiner grasps the uterus with the other hand, effects a slight retroversion, and invaginates the abdominal wall, pressing the fundus down on the palpating finger (Fig. 23). This is necessary in order to make sure that the internal finger reaches the

fundus. The examiner should push the finger up against the fundus and, by rotating it from side to side, try to obtain some idea of the character of the uterine cavity. After palpation has been completed, the uterus is once more irrigated and the patient kept in bed two or three days. It is not wise to attempt dilatation in the office or dispensary. Sometimes the pain is severe enough to require full doses of opium. The temperature must be carefully watched in order to recognize the first indication of infection as soon as possible.

As dilatation by means of laminaria tents increases the blood supply of the uterus, induces labor pains, and causes traction on the surrounding tissues, the procedure is very apt to cause exacerbations of perimetritic or parametritic inflammations. For this reason it should not be employed in cases of recent inflammatory disease in the adnexa, in tubal disease, or in the presence of hematoma in the peritoneum and broad ligament; and the structures around the uterus must, therefore, always be carefully examined before dilatation is done. The presence of virulent catarrh also makes it impossible to introduce a laminaria tent. When the uterine cavity contains decomposed material, the procedure should also be avoided, if possible; it may have to be employed, however, because the diagnosis and removal of such material is very frequently impossible without previous dilatation of the cervical canal. In cases of this kind careful disinfection is particularly important. If the above-mentioned contraindications are kept in view, and dilatation is performed only when the structures surrounding the uterus are in a healthy condition, the procedure is free from all danger. It must always be remembered that the most painstaking antisepsis is necessary. The repeated introduction of laminaria tents for gradual dilatation is to be avoided because it greatly increases the danger of infection.

Contra-indications.

Microscopic Diagnosis.

We are not unfrequently limited in our diagnosis of disease of the mucous membranes in the female genitalia by the fact that the diseased tissue, especially of the body of the uterus and upper portion of the cervix, is not accessible either to the eye or the palpating finger; while in other cases our diagnostic efforts are frustrated by the fact that the changes in the mucous membrane, in the vaginal portion for example, are not sufficiently characteristic to be attributed with any degree of certainty to a definite disease. In such cases a positive diagnosis may be reached by means of the microscope, since the histologic picture reveals specific tissue changes. The microscopic examination is therefore an auxiliary method, to be employed when all other diagnostic means have failed; and its scope is accordingly somewhat

ill defined. In disease of the mucous membrane of the body, in which inspection is of no use whatever and palpation often fails to supply any information, curettage of the uterus with microscopic examination of the scrapings is a most important resource even to the most experienced specialist. It is remarkable what surprises the microscope often prepares even for the most experienced diagnostician. Carcinoma is often discovered with the microscope in cases in which it had not been suspected, and, conversely, when the clinical symptoms point to carcinoma, the microscope may fail to confirm the diagnosis. For this reason it is urgently recommended that the scrapings obtained from the uterus be subjected to microscopic examination in every case. Whenever curettage is performed for therapeutic purposes it should also, in a sense, be an exploratory curettage. In diseases of the vaginal portion, however, the experienced eye and the practised finger are excellent diagnosticians, and the expert specialist will therefore rarely be obliged to excise a piece of tissue for the purpose of microscopic diagnosis. Not so the general practitioner, however. Owing to his limited experience he will often feel changes in consistency in the vaginal portion which will arouse the suspicion of malignant infiltration; or he may see changes in the mucous membrane the nature of which he is unable to entirely understand. To clear up every doubt of this kind with the microscope is hardly practicable because the necessary anatomical material cannot be obtained without great inconvenience and loss of time to the patient, even though the procedure may be without danger.*

The early diagnosis of uterine cancer has placed exploratory curettage and the excision of a piece of tissue in the front rank of diagnostic methods, and demands their application by every practising physician. The life of a cancer patient not infrequently depends on the conscientious employment and correct technique of these two methods for obtaining anatomical material, and they will therefore be described at length.

Exploratory Curettage.

The purpose of exploratory curettage is to obtain particles of tissue from diseased spots on the mucous membrane which cannot be seen; or, in other words, from the entire body of the uterus and the upper portion of the cervix. As in most cases there is no means of knowing at which point in the uterus the alteration which is to be subjected to microscopic examination has developed, it is not enough to obtain pieces of tissue only from definite portions of the organ, as when a

* That this comparatively trifling procedure may occasionally be fraught with danger is shown by an experience of Steinbüchel, who had a death from sepsis following curettage, probably due to an infected Nabothian follicle; hence the procedure should be resorted to only for the purpose of diagnosing changes which raise a suspicion of malignant disease.

piece of tissue is excised from spots in the vaginal portion which the eye has previously recognized as being suspicious. If in palpating the interior of the uterus definite changes have been felt in the organ, the nature of which cannot be determined by palpation, it may be justifiable to secure the tissue from the suspected portions; but it is not proper to go by what is felt with a sound, since circumscribed areas of roughness are very frequently found in that way. The surest way to avoid missing a circumscribed neoplasm is to scrape the entire intra-uterine surface and the upper cervical portion in a systematic manner. In the case of circumscribed changes the scrapings always contain a mixture of sound and diseased tissue; hence another danger of overlooking the disease if only certain portions, which macroscopically perhaps look suspicious, are placed under the microscope. The only sure method of guarding against an oversight is to examine all tissue obtained by the curette under the microscope; hence, in order to obtain all the pieces, the cervix must be sufficiently dilated to enable them to escape from the uterus, when they must be carefully collected.

Exploratory Curettage.

The technique of exploratory curettage is as follows:

The patient must be anesthetized so that the curettage may be complete. An anesthetic may be dispensed with, however, when it is desired merely to obtain a portion of a tumor which can readily be reached when the cervix is open. A physician for administering the anesthetic and possibly an assistant for holding the instruments are necessary. The following are needed: Simon's or Sims' speculum, uterine sound, double tenaculum, irrigators, uterine catheter, two curettes (broad and narrow), and metal dilators. The patient is placed on an examining-chair, and the vulva, vagina, and vaginal portion are carefully disinfected. A Simon or Sims speculum is then introduced, the vaginal portion brought into view, and the anterior lip grasped with a tenaculum. After ascertaining the direction of the uterine cavity with a sound, the cervix is dilated until it admits a moderately broad curette and the uterus is irrigated. Curettage then begins and, in order to make quite sure of reaching every portion of the uterine wall, a certain method should be followed: First, the anterior wall is scraped down with parallel strokes; then the posterior wall; then the fundus; then the right lateral angles; then the left; and finally the upper portion of the cervix. The curette must be manipulated with great care, especially when it is carried up into the uterus, as a carcinomatous or senile wall is very easily perforated, and the accident may be followed by peritonitis if the neoplasm has broken down. The scrapings begin to appear at the cervix during curettage, and what is left is later obtained by irrigation, which completes the procedure. All the pieces of tissue

must be carefully collected and at once placed in a hardening fluid. The patient should remain in bed from four to five days.

The cases for exploratory curettage are in the main those in which clinical symptoms raise the suspicion of malignant disease of the uterine mucous membrane, *i.e.*, carcinoma, sarcoma, and chorionic epithelioma. A microscopic diagnosis may also be desired when there is a suspicion of tuberculosis of the uterus, because the question of operation or of specific treatment depends on its results. Doubtful cases of extra-uterine pregnancy could be cleared up by demonstrating the presence of decidua in the uterus through a microscopic examination, but the procedure is not permissible under these circumstances because it might lead to rupture of the gestation sac and suppuration of the hematocele. For the diagnosis of simple changes in the mucous membrane such as endometritis, or the remains of an abortion, exploratory curettage is

FIG. 24.—GOODELL-ELLINGER DILATOR.

not in itself allowable; but after it has been performed for therapeutic reasons, the clinical diagnosis should in every case be confirmed by a microscopic examination of the scrapings.

[The dilator usually employed in America is the Goodell-Ellinger, which effects the dilatation either by a rapid rotary movement or slow divulsion by means of a set screw.—EDITOR.]

Exploratory Excision.

Excision of a piece of tissue is a method that is available only when the diseased parts are easily accessible to the knife or scissors, such as the vaginal portion and the lower portion of the cervix (also, of course, the vagina and vulva). This method has an advantage over exploratory curettage in that it permits the removal of definite portions of tissue which appear suspicious to the finger or to the eye. The junction between healthy and diseased tissue should be selected for the excision, in order to have the advantage of comparison in making the diagnosis.

Exploratory Excision.

This procedure can always be performed without anesthesia because it is painless, and no assistant other than a nurse is required. The necessary instruments are the Simon or Sims speculum, irrigator, long-handled knife, large forceps, double tenaculum, catgut, needle-holder, needle, and iodoformized gauze.

The technique is as follows: The patient is placed on the examining-chair and the vulva, vagina, and cervix are carefully disinfected. The cervix is then brought into view with a speculum and drawn down as near as possible to the introitus by grasping the anterior lip with a tenaculum. At the edge of the suspicious spot a wedge of tissue about 1 to 1.5 cm. long, 0.5 cm. broad, and about 0.5 cm. thick, is then excised. The hemorrhage, which is usually slight, can be arrested with one or two catgut sutures. The vagina is packed with iodoformized gauze for a day or two, and the woman kept in bed for two or three days. The excised tissue is at once placed in a hardening fluid.

The procedure is indicated chiefly in the presence of changes in the mucous membrane that suggest carcinoma or sarcoma. In addition, however, other morbid processes, such as tuberculosis and syphilis, occur in the cervix, the clinical appearance of which is not always sufficiently characteristic to make a diagnosis by inspection or palpation possible, and in such cases it is often desirable to obtain indications for treatment by means of a histologic diagnosis. Benign, non-specific processes do not require microscopic examination, and in the employment of this procedure as well as in exploratory curettage there should be a limit to diagnostic zeal.

Microscopic Examination.

The purpose of microscopic examination is to recognize conditions which are too minute to be ascertained by the unaided eye. In the microscopic examination of fluids the cellular constituents and bacteria present are studied. Fluids that are poor in cellular elements, such as urine, ovarian fluid, and fluid obtained by puncture, must be filtered and the filtrate examined; or allowed to settle in a conical glass and the sediment picked up with a pipette; or centrifugated and the sediment taken up drop by drop with the pipette and submitted to examination. Thick, mucoid fluids that are rich in cellular constituents, such as vaginal secretion, spermatic fluid, blood, pus, cervical or uterine secretion, are at once diluted with a drop of water, or a little physiologic salt solution (0.6 to 0.7 per cent.), glycerin, or a solution of iodin and potassium iodid (one part Lugol and three to four parts water), spread out on the slide with the needle, and placed under the microscope. Shreds of tissue found in the fluid are treated in the same manner as scrapings, either fresh or

Purpose.

Examination of Fluids.

hardened (see below).—Bacteria are studied by special methods: A minute portion is rubbed on a cover-glass or thinly distributed by lightly pressing it between two cover-slips, drawing them apart and allowing them to dry in the air; or the back of the cover-slip is cautiously passed through the flame. The dry preparation, thus obtained, is then covered with a few drops of the stain (methylene blue, gentian violet, or fuchsin), slightly warmed in most cases, rinsed in water, and again dried as above. It is then either mounted at once in Canada balsam, or, if certain bacteria are to be distinguished from others, these are stained with the specific staining mixture for the purpose of counter-staining, and then the remaining bacteria are stained with some other stain as described above (double-staining—counter-staining).—The special methods of demonstrating, 1, gonococci (diagnosis of gonorrhea); 2, tubercle bacilli (diagnosis of tuberculosis); 3, pyogenic micro-organisms (staphylococci and streptococci), will be described at length in the chapter on bacteriologic diagnosis (page 64).—The bacterium coli appears as short rods, often of irregular outline.—In the vaginal secretion or in the vagina the mycelium of oïdium albicans (thrush) and the parasite trichomonas vaginalis are often present.— Bacterial Examination.

Microscopic examination of tissues is made for the purpose of recognizing the minute composition, and particularly for the purpose of determining whether there are any pathologic deviations, and if so, what may be their nature. We desire to distinguish between simple and inflammatory affections and other specific alterations to determine whether the degeneration present is benign or malignant in character.—The tissue to be studied, whether it be scrapings or the excised portion of a tumor, may be examined without any special preparation (examination of fresh material). The final diagnosis can often be made at once.—Minute pieces of tissue are picked out with a small forceps (or with scissors or knife) from the selected material, placed on a slide in water, glycerin or a solution of iodin and potassium iodid (see above), and teased out with a needle. In this way chorionic villi can be identified at once by their epithelial covering and epithelial processes, and differentiated from vessels, which often resemble them, thus establishing the diagnosis of abortion or the post-partum state.—Sarcomatous changes in a myoma can thus be diagnosticated; uterine glands are readily isolated and identified by their characteristic, often ciliated, epithelium.—Instead of teasing out minute particles of the suspected material, the tissue juice may be scraped off with a knife, especially when the pieces to be examined are large. The cellular Examination of Tissues. (a) Of Fresh Material.

elements suspended in the tissue juice often supply the data for the most important diagnostications, or at least point the way to further investigation.—Finally, sections may be made of the material to be examined if the pieces have the necessary size and consistency; if the material is soft, the double knife with parallel blades should be employed. In the sections the individual portions of the tissue retain their normal connections. In addition to Lugol's solution, Löffler's methylene blue or an acid fuchsin solution may be employed.—The examination of recent material, like every other method, requires practice, and should never be neglected.

(b) Of Hardened Material.

Very often, however, the tissue to be examined—particles of tumor and the like—require special preparation for microscopic examination. It is not enough to tease out portions of material or to examine recent secretions; the supply is too limited, and it becomes important not to waste any part of it. In such cases the material to be examined must be hardened. The shreds of tissue, scrapings, or the pieces obtained by excision, should be placed at once in a 96 per cent. alcohol, or absolute alcohol, without previous washing. As a preliminary procedure it is well to shake up the shreds of tissue with a little alcohol until the blood which adheres to the tissue (in small clots and in mucus) has been coagulated, after which the pieces are poured out into another dish, from which they can readily be isolated and placed in fresh alcohol for the final hardening (preliminary selection before final hardening).—If the material is treated in this way, the surface of the pieces of scrapings, their character, which is often spongy in fungous endometritis, as well as the line of section of an excised piece, can easily be recognized—an important point for the direction of the microtome knife at subsequent sectioning. If the tumor or other diseased tissue to be investigated is extensive, the excised piece should not be too large. It is better to take several pieces from different parts of the tumor—0.5 cm. square and 0.25 cm. thick.—In a short time, one-half hour to one or two hours, the material is ready for sectioning, and may then be cut into very thin sections in any desired plane with the razor.—Besides alcohol, Müller's fluid or formalin (either dilute or concentrated) may be employed for hardening. For purposes of diagnosis these solutions are perfectly satisfactory. There are, besides, Zenker's solution, bichlorid of mercury solution and Flemming's solution. In examining scrapings or shreds of tissue which are mixed with blood, it is always best to shake them up in alcohol as described, and place them in fresh alcohol for hardening without previous rinsing; in all other respects the method is the same as just described.—An important preliminary treatment of the material to be examined consists in freez-

ing, and sectioning with the freezing-microtome. For freezing ether or compressed carbon dioxid may be used. The sections are "planed," placed in water, and then, if desired, fixed in formalin or alcohol, after which they are ready for examination; but even when the freezing-microtome is employed it is always best to subject the scrapings or excised piece of tissue to a preliminary hardening in absolute alcohol (see above), remove the alcohol with formalin, and the latter with water; or to harden directly in formalin and then wash in water. As the pieces of tissue in such cases are usually small, this procedure requires no more time than freezing fresh material. The whole process can be completed in from one to two hours, or even less if the pieces are small.—Difficulties which occasionally arise when the sections are made at once with the freezing-microtome without previous preparation of the material, such as blurring of the microscopic picture, are in this way avoided. A rapid diagnosis based on sections obtained with a freezing-microtome, without previous hardening, may be unreliable in an individual case, and is usually not necessary.

Examination of Frozen Sections.

It may happen that hardening with alcohol, Müller's fluid, formalin, Zenker's solution, bichlorid or Flemming's solution, without embedding, may not be sufficient even for diagnostic purposes. The individual portions are not sufficiently held together, and go to pieces in the washing, staining and mounting. For this reason embedding is a third method of extreme importance for diagnostic purposes. It is employed more than any of the others because with a little care it combines the advantages of the other methods, and has special advantages of its own, particularly the ease with which serial sections can be prepared.—

Method of Embedding.

For the microscopic examination of gynecological specimens, particularly for diagnostic purposes, embedding in celloidin is the best method.—The celloidin is dissolved in ether, and solutions of varying strength are prepared ("thick celloidin"—"thin celloidin"). The longer the preparation can be soaked in the celloidin the better will be the sections. The material to be studied, the size and preliminary preparation of which have been discussed, is first completely dehydrated in absolute alcohol; it is then placed in a mixture of ether and alcohol for from one to two to twenty-four hours, depending on the size of the pieces; then in thin celloidin solution, which is gradually replaced with stronger solutions. The imbibition should be as nearly uniform as possible,—from two to four to twenty-four hours, depending on the size of the pieces, may suffice.—The pieces are then "cast"; that is, they are placed in a small, round glass vessel or adjustable metal receptacles, which can be adapted to the size of the object, or into little boxes or baskets made of paper.

Celloidin Method.

—The pieces are then so placed that the sections will be made in the desired plane.—The celloidin cast is now placed under a glass bell-jar until it has evaporated to a soft elastic consistency; the masses of celloidin, with or without the containing vessel, are then placed in 66 per cent. alcohol, in which the celloidin around and in the pieces of tissue becomes fully hardened.—These hardened masses are glued to blocks of wood with celloidin, after dipping the blocks for a few moments in ether and alcohol, or alcohol alone, to make the celloidin adhere. The blocks may be of earthen-ware instead of wood. Pieces of cork were formerly employed, but have been discarded because they exude substances which interfere with the tingibility of the embedded masses.—

This ends the process of embedding, and the pieces remain in 66-per-cent. alcohol, either whole or in sections, and may be examined under the microscope at once, or kept for later study.—The sections should be made with a microtome, although they can be made by hand. —The sections are removed from the microtome with a brush or the tip of the finger, and placed in water; they are then stained, washed, dried as well as possible with filter paper, and placed in 96-per-cent. or in absolute alcohol, in order to remove the last remains of water from the preparation; but the sections must be removed from the alcohol as soon as the celloidin begins to soften and dissolve. They are then placed in carbol-xylol, laid on the slide, the carbol-xylol removed, and the preparation mounted in Canada balsam. The sections must be transparent. If they contain whitish spots that do not clear up, it is a sign that dehydration has not been complete, and the procedure must be repeated.

The only other embedding material besides celloidin that deserves mention is paraffin. Embedding in albumin or in a mixture of gum arabic and glycerin, while it has its advantages, may be passed over.

Embedding in paraffin is suitable for small, soft pieces of tissue. The pieces to be embedded require the preliminary treatment with alcohol as when celloidin is used. After dehydration in alcohol the tissue is placed in xylol, and paraffin gradually added until a saturated solution is obtained. In this way the tissue becomes thoroughly saturated with xylol, xylol-paraffin.—The xylol is gradually evaporated in a thermostat by raising the temperature to 50° C.; and finally the tissue to be examined is embedded in the congealing paraffin by cautious but rapid cooling.—The tissue is then trimmed up, glued to the block of wood (cork or metal base) with paraffin, and cut with a paraffin-microtome, which is placed vertically to the object, in contradistinction to the position of the knife in cutting celloidin preparations, when the edge of the knife is

Paraffin Method.

drawn lengthwise over the cut surface, keeping the edge of the blade in contact with the tissue as long as possible.—The sections are readily floated out in water and placed on the slide, which is first painted with albumin-glycerin, so that the sections will adhere. The section is then dried in the thermostat by raising the temperature to 37° C., covered with xylol, and mounted in Canada balsam.—As a rule the sections are previously stained *in toto* (staining of the entire piece); if not, they are now placed in water, then in the stain and, after washing, in alcohol, xylol, and Canada balsam. With a suitably prepared right-angled block, tissue embedded in paraffin can readily be cut in serial sections. The sections, which form a continuous "ribbon," are placed in water and then on the slide, and numbered before they are mounted.—

Staining of the Sections.

Sections prepared for microscopic examination are stained so as to differentiate the details of the histologic structure. The methods of staining recent material have been discussed. For hardened or embedded sections there are various stains and a variety of methods and combinations (double staining). Not only the nuclei, but the protoplasm of the elements as well, and the outlines of the cells should be stained with the greatest possible uniformity and expedition.—The simplest method, and one which in most cases is perfectly satisfactory, consists in staining the sections with alum-carmine, as there is no danger of over-staining. When celloidin sections are left in the stain too long, the celloidin often becomes colored and confuses the microscopic picture. In many cases a few minutes suffice for this purpose. After the excess has been washed off, the section is placed in alcohol for the purpose of dehydration and, before the celloidin has begun to dissolve, in alcohol and xylol-carbol. It is then placed on the slide, the xylol-carbol removed, and the section mounted in Canada balsam.—A still more complete differentiation is obtained by means of haemalaun, but the section must not be allowed to remain more than a short time, often only from one-half to one and a half minutes, in the fluid. Hæmalaun will stain necrotic tissue that is not affected by alum-carmine.—The haematoxylin method is also to be recommended. Counter-staining (double staining) is effected by means of eosin, picric acid or van Gieson's fluid. The sections are placed a few minutes (from eight to ten or twelve) in the hæmatoxylin solution, then in an acid solution (containing hydrochloric acid) from one to two or three minutes for the purpose of differentiating, washed in water, dehydrated in absolute alcohol for from one-half to two minutes, cleared in carbol-xylol and mounted in Canada balsam. —For the purpose of counter-staining (double staining), the sections after passing through haematoxylin are placed in an alcoholic solu-

tion of eosin from one to two minutes, and then thoroughly dehydrated in alcohol, which to be sure removes part of the eosin.—In van Gieson's method the sections are somewhat over-stained with hæmatoxylin and then placed for from three to five minutes in a solution of picric acid and acid fuchsin, quickly washed in water (one-half minute), dehydrated in alcohol, cleared in xylol, and mounted in Canada balsam—the muscle fibres are stained yellow, the connective tissue red.—

There are quite a number of other excellent methods, and each of them undoubtedly has its special value for one who is familiar with the particular method: lithion-carmine, borax-carmine for soft embryonal tissue. Excellent pictures can be obtained by treating the sections with liquor ferri sulphatis oxidati (one part to two of distilled water), either by itself or with a counter-stain; the sections are first soaked in distilled water and placed from two to twenty-four hours in the above solution; then for from one to twenty-four hours in yellow hæmatoxylin (the latter must be dissolved in absolute alcohol and then mixed with distilled water) until the solution has approximately the same color as the caustic staining solution; later this solution turns dark, almost black, which however does not interfere with its usefulness. When the sections are first taken from the solution they are almost black and are placed in hydrochloric acid solution (10 : 100) or in glacial acetic acid (30 : 100) (slow method) for the purpose of differentiation, until the color becomes sufficiently brown; they are then rinsed in distilled water and immersed for some time in running water until the color is a beautiful, intense blue (Benda's method).

A very beautiful method, which is quite as good as the somewhat complicated one of Benda and requires less time, is that of Weigert. The following solutions are employed: (a) One gram of hæmatoxylin in 100 c.c. of 96-per-cent. alcohol; (b) 4 c.c. of sesquichlorid of iron solution, 1 c.c. of official hydrochloric acid, and 95 c.c. of water. The solutions a and b are freshly mixed in equal parts each time; the black mixture which results is ready for use in a few minutes.—The sections are then rinsed in water and briefly immersed in a mixture of saturated solution of picric acid, 100 parts (at room temperature), and one-per-cent. watery solution of acid fuchsin, 10 parts, hastily rinsed in water, dehydrated in 96-per-cent. alcohol, cleared in carbol-xylol, and mounted in Canada balsam.

The following points are of importance in preparing sections for microscopic examination: (1) The plane of section. Since changes in the mucous membrane are most frequently the object of gynecologic diagnosis, whether the tissue to be examined is obtained

by curettage or by excision, the plane of section should be as nearly as possible perpendicular to the surface of the mucous membrane, in order to obtain sections of the deeper portions of the tissue. If the recent scrapings are treated with alcohol as described above, the material again examined, and the pieces of tissue suitably placed in celloidin, the plane of section can be perfectly controlled. Although the scrapings often contain such an abundance of particles which, when embedded *in toto*, present longitudinal, as well as transverse and oblique sections even without preliminary selection, nevertheless the certainty with which the plane of section can be influenced by selecting the pieces beforehand is worth the trouble, which is not very great.—When a piece has been obtained from the centre of a tumor, the plane of section should, if possible, be made double, *i.e.*, in two planes superimposed vertically one above the other; quite often the double direction is unnecessary, however, as the picture obtained with the first may give all the necessary information. (2) The thickness of the sections must be uniform. This demands good embedding and a sharp knife. (3) The sections must be in the same plane and not wavy. The use of an excessive amount of Canada balsam in mounting is to be avoided. Later a small weight (piece of lead) may be laid on the cover-glass to assist in spreading the preparation out uniformly. (4) The staining must be properly carried out (see above). (5) The sections selected for diagnostic purposes must be neither too thin nor too thick. For a general study with low magnification sections from 15 to 20 μ are sufficient, and for finer study, from 10 to 15 μ. Some specimens must be cut thin, while for others thicker sections are equally satisfactory. In the case of villi, decidual tissue and sarcoma thin sections are to be preferred; simple hyperplastic changes of the endometrium can be studied better when the sections are somewhat thick.—(6) The sections should be placed on the slide in such a way that the surface of the mucous membrane is parallel to one side of the slide; in the case of inflammatory changes in which, for example, the glands of the uterus usually proliferate far beyond their normal limits in the muscle, it is a great convenience to have well-placed microscopic preparations.—(7) A most important step in the examination consists in careful inspection of the sections with the unaided eye for the purpose of orientation. With a very low magnification, from two to four diameters, as with an ordinary loupe, much of the composition of the tissue and many pathologic alterations can be seen. Even with the unaided eye the dilated uterine glands in fungous endometritis are quite visible; the cancerous alveoli are

Preparation of Microscopic Sections.

Thickness of the Sections.

Staining.

Position of Section on the Slide.

Careful Macroscopic Inspection.

quite distinct; in stained preparations the edge of the mucous membrane stands out sharply. With a little practice mere inspection of the microscopic preparation will enable one to make a provisional diagnosis of abortion (*status post abortum*). After the section has been studied with a low magnification (1 to 20, with a loupe) the sections are worked up with a higher magnification—from 50 to 100 times suffices to clear up everything in most cases.—It is extremely important to get a general idea of the preparation under low power and to make a provisional diagnosis. Indeed, in many cases low magnification suffices for the final diagnosis; while, on the other hand, there are changes which can only be positively diagnosed with high magnification, such as certain decidual changes and sarcomatous degeneration.

Purposes of Microscopic Examination.

Microscopic examination may be demanded for a variety of reasons. It may be desired to confirm the clinical diagnosis, even if it does not seem to be necessary. Sometimes a clinical diagnosis which is apparently positive has to be revised after a microscopic examination has been made; for example, a uterine tumor said to be malignant has been recognized later as the remains of an abortion (greatly altered placental polyp). In the second place, it may be required to clear up doubtful cases in which no positive clinical diagnosis can be made. Contradictory views of individual examiners, as, for example, whether a degeneration of the vaginal portion is malignant or not, are settled by the microscope by examining an excised portion or the scrapings.—Alterations which are not recognized clinically, as to the benign nature of which, for example, there appears to be no doubt whatever, may be positively demonstrated to be malignant by the microscope.—Microscopic examination is resorted to for the purpose of recognizing the existing conditions as early as possible, in order that treatment, if necessary, may be applied early and the corresponding prognosis made. The waiting policy—*ex juvantibus ex nocentibus*—has very scant application in gynecology.—

Early Diagnosis.

Sources of Error.

There are numerous sources of error to be guarded against in microscopic examination. In the first place, the material supplied for examination may be unsuitable or insufficient in quantity. In a suspicious case of malignant degeneration of the uterus the focus may be quite small, or situated in the angle of the tube so as to escape the curette, and in such a case the diagnosis based on the scrapings may be erroneously favorable, and the apparently exact microscopic proof of benign alterations may prove fatal to the patient. Although in cases of this kind the material supplied to the

Vaginal Wall

pathologist, and not a faulty examination, is responsible for the faulty diagnosis, mistakes may occasionally be due to the fact that the pieces examined are too small, as when a diagnosis is based on a teased preparation, or on a spread of the tissue juice. A sarcoma cell is difficult to distinguish from a decidual cell, for the latter must be regarded as the physiologic type of the former. A small-celled sarcoma cannot be distinguished from inflammatory infiltration if only small portions of the tumor are examined. The individual element of a malignant adenoma—the cylindrical cell—can hardly be distinguished from the cell of a glandular endometritis. Particles of squamous epithelium simulate cancer nests.—While examination of teased specimens and of recent material should not be neglected, and it is quite true that it may afford indications for still further investigation or even suffice for making the diagnosis, it is nevertheless preferable in the main to depend for a gynecologic diagnosis on regularly prepared, embedded and sectioned material. Even a minute piece of tissue, barely as large as a lentil, may, if properly worked up, give positive information and furnish the basis of a definite diagnosis. The most minute particles of tissue not infrequently suffice for the diagnosis of malignant neoplasms.—On the other hand, even when the tissue has been well prepared and well embedded, and the staining properly carried out, the interpretation may be exceedingly difficult. Thus, the diagnosis of a specimen from hydatid mole, when persistent hemorrhage clinically arouses a suspicion of malignant degeneration and the scrapings contain large syncytial masses among the muscular and decidual elements, may present the greatest difficulties. —While occasionally minute pieces suffice for a diagnosis, in other degenerations the diagnosis may be difficult even when large portions are examined.—It is very difficult to determine whether abundant, so-called "syncytial migratory cells" are benign or malignant.—Another source of error arises from deceptive appearances in the preparations themselves, which will escape all but the practised eye.—Horizontal and longitudinal sections of glands and of the fundi of glands are apt to simulate multiple layers; changes consisting in conversion into epithelial tissue (epidermidalization) are apt to simulate beginning carcinoma, particularly when the line of section is not vertical; changes in and around polypi may look like malignant degeneration; and the glands of pregnancy are apt to suggest the diagnosis of glandular carcinoma.— Deceptive Pictures.

Aside from these sources of error, which can be avoided by care and practice, or by examining the specimen from a second curettage or excision, there may be occasionally certain other insurmountable difficulties, as, for example, in the beginning of a malignant degeneration.

—The limitations of microscopic diagnosis in this respect are such as to baffle even the most practised observer. In a tuberculous ulcer it may be impossible to demonstrate either tubercle bacilli or giant-cells.—In spite of its limitations microscopic examination plays a most important part in gynecologic diagnosis. It of course presupposes a knowledge (a) of the normal structures, and (b) of pathologic changes. Practice eliminates most sources of error and reduces the limitations to their minimum. One of the best exercises for developing the observer's skill and making him quick to note sources of error consists in making drawings of microscopic preparations: when one attempts to reproduce correctly on paper what we have seen, one is forced to observe accurately.

Limitations of Microscopic Diagnosis.

Prerequisites of Microscopic Diagnosis.

A not unimportant factor in the success of microscopic examination is the preparation of the material to be examined, and the way in which the piece has been removed or excised. The material is obtained by curettage and by excision, and the method of treating this material has been given. It is, however, exceedingly important, before cutting up a preparation, and in fact before touching it, to make a careful inspection. With a little practice one learns to pick out the part best adapted for microscopic examination. But as it is not always possible to see everything clearly and select the desired portion of the material, we should make it a rule not to destroy anything and not to frustrate a subsequent examination by unskilful sectioning and cutting out of pieces—a sure sign of ignorance—as, for example, cutting out unnecessarily large, four-cornered blocks. In most cases flat pieces or disks from two to three mm. wide are large enough. There is room for artistic excellence even in preparing the material.

Treatment of Material to be Examined.

Cystoscopy.

Cystoscopy has become an indispensable aid to gynecologic examination. Diseases of the female genitalia and diseases of the bladder are in many respects very closely related. Some diseases, on the one hand, develop simultaneously in both the reproductive and the urinary apparatus, as gonorrhea, tuberculosis and fistula; while, on the other hand, diseases of the bladder are prone to develop in the course of some gynecologic affection. Thus, a carcinoma of the uterus may extend to the bladder, purulent cystitis may result from rupture of an exudate, a tumor, or a pyosalpinx. Functional disturbances of the bladder caused by diseases of the genital organs are even more frequent —ischuria with pelvic tumors, tenesmus from stenosis of the lumen, distention of the fundus of the bladder, myomata of the gravid uterus,

sacculations of the bladder in prolapse. The spatial and functional association of the urinary apparatus with the genital organs in itself usually brings women who are suffering from disease of the bladder to the gynecologist, who, even if he confines his practice strictly to gynecology, is therefore forced to familiarize himself with the diagnosis of vesical diseases.

According to Knorr, 663 out of 3213 patients who came to his gynecologic dispensary, or 20.6 per cent., complained of vesical symptoms. Of these, 509 were actually suffering from disease of the bladder, while 154 had vesical symptoms due to some gynecologic disease.

Another consideration is that important diagnostic information bearing on diseases of a purely genital character may be obtained through the bladder, as, for example, the extent of a carcinoma and the signs of an impending or already existing rupture of an exudate.

In order to solve the diagnostic problems which present themselves to the physician by reason of this close relation between the two systems and their special diseases, he is obliged to resort to cystoscopy in addition to the other methods of examination. No gynecologist is completely equipped for the practice of his specialty until he has mastered the cystoscope. For this reason I deem it necessary to describe in detail at this point the technique of cystoscopy and to discuss the indications for its employment, reserving the pathologic results of the examination for the special portion of this work. I wish to emphasize, however, that proficiency in this method of examination can only be acquired in special courses of instruction.

FIG. 25.—MODIFIED NITZE CYSTOSCOPE. ½. (Original.)

Nitze's cystoscope is employed. For the female bladder alone the modification of the instrument which I have devised will be found of advantage (Fig. 25). To correspond with the short female urethra I had Nitze's cystoscope reduced in length to 21 cm.; the advantage is that the shorter instrument is less likely to slip out of the bladder. I also flattened the angle of the tip which contains the lamp, so as to make it possible to obtain a better view of the fundus without having to depress the handle of the instrument too much. As the female bladder is often greatly contracted, the movements of the male cystoscope, which is too sharply bent at the tip, are restricted. The source of light should be an accumulator.

Cystoscope.

Cystoscopy may injure the patient by causing infection of the bladder, hence the most painstaking asepsis is necessary. The instru-

ments cannot be disinfected by boiling because the water would destroy the lenses. Superheated steam is also injurious if used for any length of time, and this method of sterilization should therefore be employed only after the instrument has been used for examining infectious cases, as, for example, tuberculous patients, when absolute disinfection is imperative. For ordinary use a sufficient degree of asepsis can be obtained by keeping the instrument immersed in a 3-per-cent. solution of carbolic acid. If the cystoscope is used daily, and several times a day, it should be kept constantly in tall glasses filled with a 3-per-cent. carbolic acid solution (Fig. 26). Immediately before the instrument is used, the part which is introduced into the bladder should be once more thoroughly rubbed with the same solution. The lenses resist continuous immersion in fluid for a long time. Casper prefers to dispense with the protracted use of disinfectants because they injure the instrument, and cleanses it merely by briskly and thoroughly rubbing it from time to time with cotton dipped in tincture of green soap. Stöckel recommends that the cystoscope be kept in an atmosphere of formalin vapor, generated by placing formalin tablets in vessels devised by Nitze for the reception of the instrument.

Asepsis.

FIG. 26.—CYSTOSCOPE IN CARBOLIC ACID SOLUTION AS IT SHOULD BE KEPT WHEN IT IS IN CONSTANT USE. (Original.)

The introduction of germs from the patient's mucous membrane is avoided by thoroughly scrubbing the urethral orifice with a disinfectant. The urethra itself does not usually need to be cleansed. Gonorrhea of the urethra is an absolute contraindication to cystoscopy. In the chronic stage, when there is but little discharge, there is no objection to this investigation provided the patient has previously urinated. As in spite of every precaution it is not always possible to prevent the entrance of micro-organisms, the water should be drawn off immediately after the cystoscopic examination has been completed, or the bladder may be irrigated with a 3-per-cent. boric acid solution. The danger of infection is increased by mechanical injury of the vesical mucous membrane, and by leaving the instrument in the bladder too long. The examination should therefore be carried out cautiously and rapidly. In the hands of a practised cystoscopist infection is rare.

In performing cystoscopy the woman is placed on the examining-chair in such a way that the genitalia are just on a level with the exam-

iner's eye. The urine is then drawn off with a catheter and, if it is clear, the examination may be made at once. If it is turbid, the bladder must be irrigated with a 3-per-cent. boric acid solution until the fluid returns absolutely clear. During the examination the bladder must be filled with about 200 grams (6 ounces) of a 3-per-cent. boric acid solution. After lubricating the tip with glycerin, the cystoscope is introduced slowly into the urethra and carried back into the bladder; the circuit is then closed. By turning the cystoscope the light is thrown successively on the fundus, the upper wall, and finally the anterior and lateral walls of the bladder. (Space forbids more than a short description of the cystoscope in this place, and the reader is referred for further details to the special text-book by Nitze and Casper, and especially to Stöckel's "Cystoskopie des Gynäkologen.")

Technique.

Cystoscopy in the female differs from the same procedure in the male in certain very important respects, owing to differences in the shape of the bladder and its relations with the adjoining genital organs. The male bladder owing to its spherical shape is very well adapted for cystoscopy; the female bladder, on the other hand, is flattened at the base, particularly from before backward, while the upper wall is superimposed on the lower wall like a dish, so that the two walls form a fairly acute angle with one another. If, in addition, the uterus lies on the bladder, the fluid injected into the viscus usually settles in the lateral portions, and it requires great distention to produce the desired spherical shape and to elevate the uterus. The cystoscope is therefore forced to adapt itself to the flattened shape of the bladder, and illumination of the sacculations and pockets of the organ can only be achieved by constantly moving the instrument about. Under ordinary conditions the difficulties are not excessive; but they are considerably increased, and often become insurmountable, if the bladder is dislocated by displacements of the uterus, tumors of the uterus and adnexa, and particularly by tumors developing in the cervix or vagina. The latter push the fundus of the bladder forward so that, even when the handle of the instrument is depressed as far as it can be, it is barely possible to obtain a view of the fundus and the orifices of the ureters. Dislocation of the fundus of the bladder and of the ureteral openings is the main difficulty experienced in performing cystoscopy in the female.

An excellent auxiliary method for ascertaining the secretory activity of the kidneys and functional condition and permeability of the ureters is found in chromo-cystoscopy, as devised by Völcker and Joseph. The principle of the method consists in rendering the stream of urine visible by means of indigo-carmine. An injection of 4 c.c. (1 fluidrachm) of a sterile, 4-per-cent. solution of indigo-carmine is made in the gluteal region about twenty minutes

Chromo-Cystoscopy.

before cystoscopy is performed. The urine, which is stained blue, is then readily seen as it flows out of the ureters, so that the position of the ureteral openings is easily found, the activity of the ureters can be determined, and closure of the canals, or the presence of fistulæ readily diagnosed. Chromo-cystoscopy is destined to render catheterization of the ureters superfluous in many cases.

Cystoscopy will always be a method of examination fraught with discomfort to the patient and, in spite of all precaution, with danger as well. It should therefore not be employed in every case that presents vesical symptoms, but only when they are not sufficiently explained by simple methods of examination of the urine, and cannot be ascribed to conditions found in the genitalia. Cystoscopy is necessary in the following conditions:

Indications.

1. In certain forms of catarrh of the bladder: thus, in long-protracted and severe catarrh; in catarrh associated with intense symptoms, when the urinary findings are inconsiderable, in order to determine the character of the process and the degree of alteration in the vesical wall. Cystoscopy is indispensable also when there is reason to suspect, as the primary cause of the catarrh, tumors, stones, foreign bodies, or ulcerative processes. In acute catarrh cystoscopy should not be employed.

2. If there is pyuria, cystoscopy is necessary in order to decide whether it comes only from the bladder wall or from diverticula, perforated abscesses or pyosalpinx; or whether it is derived from the ureters or the kidneys.

3. Hematuria, except in cases of slight hemorrhage with acute or gonorrheal cystitis, always calls for a cystoscopic examination, particularly if the amount of blood is large, or the hemorrhage is protracted, or frequently repeated. The main point to determine is whether the blood comes from the bladder or from the kidneys. As hemorrhage from the bladder interferes very much with cystoscopy, while bleeding from the kidney demands an examination before the hemorrhage has ceased, the cystoscope should be introduced at once during the continuance of the hemorrhage in order not to waste time, and the examiner should determine whether there are changes in the vesical wall, or the blood comes from one of the ureters. If the former is the case, an accurate diagnosis of the changes present must be postponed until the examination has been repeated during the interval between the hemorrhages.

4. When the history of the case, the examination of the urine, and the palpatory findings point to tumors, stones, or foreign bodies in the bladder.

5. When vesical symptoms cannot be explained either by the examination of the urine or by the conditions found in the genitalia.

6. For the diagnosis of certain changes in the genital organs which cannot be recognized by combined examination,—such as the extent of a carcinoma, impending or existing perforation of exudates, pyosalpinx, dermoid tumors, extra-uterine pregnancies; displacement due to myomata and other tumors; localization of genital fistulæ.

7. For the diagnosis of diseases, fistulae and occlusion of the ureters.

8. For the diagnosis of functional disturbances and diseases of the kidneys.

Catheterization of the Ureters is a method of examination which the gynecologist is also occasionally obliged to perform if he wishes to retain complete control of his specialty without any outside assistance. The best instrument for the purpose is Casper's ureter-cystoscope (Fig. 27). This is a cystoscope with an upper, semicylindrical groove, which is covered by the sliding semicylinders that act as carriers of the ureteral catheter. The funnel-shaped eye-piece is cut out so as to permit the catheter to be introduced in the proper direction; the handle, which is attached to the catheter, pushes it forward and draws it back, thus giving the catheter the necessary curvature for effecting an entrance into the ureter. For the purpose of simultaneous catheterization of both ureters double-barreled metal tubes have been devised which hold two catheters at the same time. The two principal features of Casper's ureteral cystoscope are that the curve of the catheter can be regulated and that the catheter canal can be converted into a groove by means of a removable cover.

Catheterization of the Ureters.

FIG. 27.—CASPER'S URETERAL CYSTOSCOPE. (Newest model.)

The ureteral cystoscope is disinfected in the same way as the ordinary cystoscope. The metal tubes that carry the catheter may be

boiled. The catheters themselves are completely wrapped in cotton and sterilized by an exposure of three-quarters of an hour to superheated steam.

Technique.

Catheterization of the ureters is not a difficult procedure in the hands of a practised cystoscopist. An absolute prerequisite, of course, is a clear view of the ureteral openings. If they are hidden in folds of the mucous membrane, or are unusually small, they are difficult to find. In the female catheterization of the ureters is rendered difficult and not infrequently impossible when the fundus of the bladder is displaced greatly by the traction of a displaced uterus, or the encroachment of tumors of the uterus or adnexa. Sometimes the finding of the ureteral openings may be assisted by grasping the anterior vault of the vagina with a tenaculum and drawing the fundus of the bladder in various directions. The cystoscope is introduced into the bladder with the catheter completely concealed, and the opening of the ureter to be catheterized is found. By elevating the funnel end, and at the same time carrying it to the opposite side, the tip is brought as near as possible to the ureteral opening and, as soon as it is directly opposite, the catheter is gently pushed in. By elevation, depression, and lateral movements of the handle, the tip of the catheter is guided into the ureteral opening and, as soon as this is passed, the catheter is cautiously carried upward in the direction of the ureter. If the catheter is to be allowed to remain, the cover and metal tube are withdrawn, leaving it free, and the cystoscope is removed. (For further details see Casper and Stöckel.)

Catheterization of the ureters adds to the ordinary dangers of cystoscopy the special danger of injury to the mucous membrane and infection of the ureter or pelvis of the kidney, especially when the bladder is diseased. Although traumatism may be avoided by care and practice, and the danger of infection minimized by the most scrupulous attention to asepsis and thorough disinfection of the diseased bladder, the use of the catheter should nevertheless be kept within narrow bounds. Since chromo-cystoscopy has still further diminished the indications for its employment, catheterization of the ureters has become practically unnecessary for purely gynecologic purposes. It is only employed:

Indications.

1. In order to obtain the secretion of one kidney.

2. When chromo-cystoscopy has failed to yield positive information as to the permeability and functional state of the ureter.

3. In a few cases in order to mark the position of the ureter for operations in its immediate neighborhood (ordinarily the ureter is sufficiently marked without a catheter).

[While the Nitze and Casper cystoscopes, as modified by several American gynecologists and surgeons, are in popular vogue for vesical

examinations and catheterization of the ureters in this country, and for ordinary examinations are very effective, nevertheless every gynecologist should be familiar with the Kelly method of cystoscopy. Although the knee-chest position may be objectionable as well as tiresome to the patient, and likewise may be fatiguing to the examiner, nevertheless in many instances this method alone is advisable if the best results are to be obtained. For instance, the treatment of local conditions, such as a tuberculous ulcer, etc., can only be effected through the Kelly cystoscope. The following description of this method, as conducted by Kelly, has recently been given by Hunner in Kelly and Noble's "Gynecology and Abdominal Surgery."

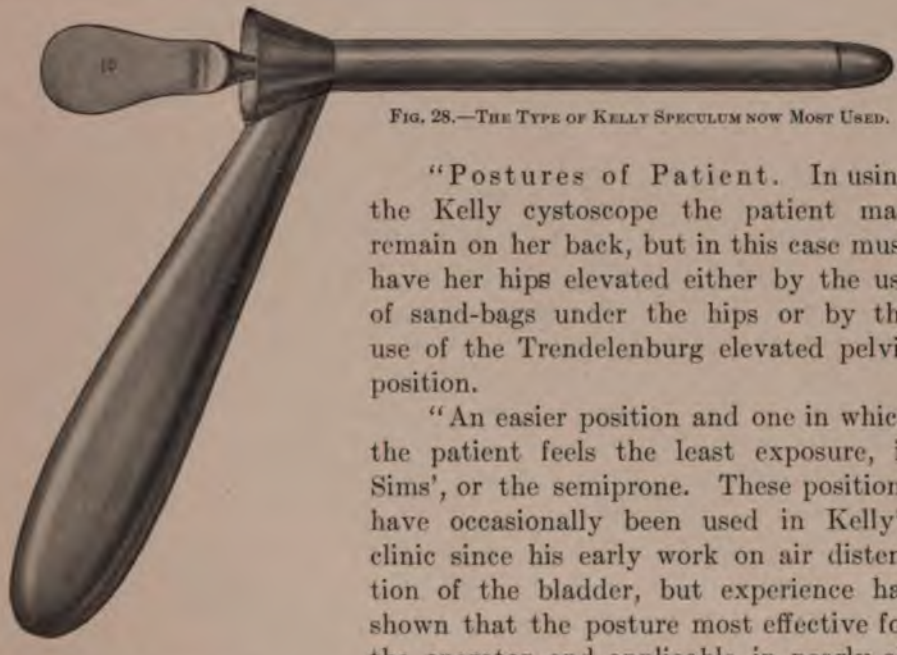


FIG. 28.—THE TYPE OF KELLY SPECULUM NOW MOST USED.

"Postures of Patient. In using the Kelly cystoscope the patient may remain on her back, but in this case must have her hips elevated either by the use of sand-bags under the hips or by the use of the Trendelenburg elevated pelvic position.

"An easier position and one in which the patient feels the least exposure, is Sims', or the semiprone. These positions have occasionally been used in Kelly's clinic since his early work on air distention of the bladder, but experience has shown that the posture most effective for the operator and applicable in nearly all cases is the knee-chest. The patient finds this position awkward at first, but with a little experience the posture is easily taken and maintained.

"It is probable that most failures in cystoscopic work by use of the knee-chest method are due to the neglect of a few important and essential rules. The principle of this method is to obtain as great evisceration of the pelvis as possible. There should, therefore, be no band or binder of any sort constricting the upper abdomen. The patient should be in the knee-chest, not the knee-elbow position. The knees should be slightly anterior to a vertical line let fall from the hip-joint. The trunk muscles must be relaxed, giving the back a downward, rather than upward bow.

"After incorrect posture of the patient, perhaps the most fertile source of embarrassment in this work is the failure to dilate either the

rectum or the vagina with air before dilatation of the bladder. If the bladder is first dilated, its distention takes place in the direction of least resistance, which is towards the potentially empty pelvis, or, in other words, toward the base of the bladder. This carries the vesicovaginal septum upward, and with it the ureteral orifices are carried beyond the range of easy vision. On the other hand if the rectum or vagina, or both, are first allowed to fill with air, the vesicovaginal septum is ballooned ventrally, thus carrying the ureteral orifices downward. Now if the speculum is introduced in the bladder and this viscus is allowed to fill with air, the vesicovaginal septum is carried upward to a considerable degree, but usually it does not rise above a plane which is parallel with the plane of the table; in other words, the ureteral orifices are usually found on a level with, or even below the speculum when this is held in a horizontal position.

FIG. 29.—DILATING THE EXTERNAL URETHRAL ORIFICE with the Graduated Cone Dilator.

"If the above simple but essential rules are observed, cystoscopy with the use of air distention of the bladder will be found to be a very easy method. There are minor points of technique which one learns by experience, and a few of them may be mentioned here.

"It is not fair to the patient to keep her in position while one is taking his first lessons in the use of the head-mirror. The cystoscopist should become thoroughly familiar with the necessary instruments and the reflected light by working with an empty pasteboard box or other hollow structure before even attempting to examine a patient.

"Technique of Cystoscopy.—Having made the general physical examination and taken a culture from the urine, how shall we examine the new patient with the cystoscope? With a pipet cocain, in 5- or 10-per-cent. solution, is introduced in the urethra and the patient is changed to the knee-chest position. By the time this position is taken the cocain has deadened the more acute sensibility of the urethra, and its external orifice can be stretched to the required size by means of the graduated cone dilator (Fig. 29). Occasionally the external urethral orifice is found to be 1 cm. in diameter, but it generally takes

the cone dilator only to the 6 or 8 mm. mark, and must be considerably stretched before it will take the No. 10 (10 mm.) speculum. If done gently with a boring motion and with the cone well lubricated, this

FIG. 30.—MEDIAN SECTION, KNEE-CHEST POSTURE, showing the anatomic relations of the pelvic organs when the rectum, vagina, and bladder are dilated by atmospheric pressure. Also the curves of the urethra. (Kelly.)

stretching can generally be carried to 10 mm., or even beyond, without pain to the patient, and without splitting the mucosa. If the external urethral orifice is unusually small, or if the surrounding tissues are indurated from previous vulvitis or urethritis, it may be necessary to use a No. 8 or No. 9 speculum for the first examination. One should make

it a rule to avoid hurting the patient at the first examination. It is better to be satisfied with only partial examination for the first, and even for the second and third visit, provided the patient's confidence is gained.

"It seems scarcely necessary to give directions for the insertion of the speculum. But the operator must bear in mind the anatomy of the urethra and follow its natural curves. The speculum is pointed slightly upward until it engages the external urethra, when its handle is elevated so as to direct the barrel downward over the symphysis pubis. On withdrawal of the obdurator the inrush of air into the bladder balloons the vesicovaginal wall upward, and if the handle of the speculum is dropped, its weight will bring the barrel of the speculum against the base of the bladder, and the speculum is found to take a position about horizontal.

"The usual routine of the examination is, first, to sweep the speculum about the entire bladder, noting any mucous membrane changes; second, to examine the vertex carefully for the presence of stone or other foreign body; third, to examine the area immediately back of the symphysis, using the fingers of one hand when necessary to push up the abdominal wall in the suprapubic region; fourth, to carefully examine the trigonum and the regions of the ureteral orifices. If a trigonitis or ulceration of the trigonum be suspected, it is best to examine this region first, before it has been disturbed by manipulations of the speculum. If the symptoms point to a urethritis, a small speculum should first be used and the urethra examined at once before it becomes hyperemic from massage by the speculum.

"After one is familar with cystoscopy, the ureteral orifices can usually be located at once without following a definite rule; but for the beginner the directions laid down by Kelly should always be followed. After finishing the general examination of the bladder the speculum is withdrawn until the mucous membrane of the internal urethral orifice begins to close about the inner end of the speculum. The handle is then tilted upward and the speculum is pushed in toward the center of the bladder for a distance of about three centimeters. The handle is then depressed in order to bring the inner end of the speculum to a plane with the base of the bladder, and under guidance of vision the speculum is swept to the side until the ureteral orifice is located. This is usually in the arc of an angle of between 15 and 30 degrees from the mid-line. The left ureteral orifice should be sought first, for in the majority of cases it is more easily found, owing to the depression of the left vesicovaginal wall by the weight of the uterus and the cervix. For the same reason the left orifice is slightly nearer the internal urethral orifice than the right. The air-pressure carries the right orifice farther up toward the sacrum and flattens the mons ureteris of this side.

"When searching for the ureteral orifices the most helpful landmark is the interureteric ridge. If, after following the above directions, the ureteral orifice is not found, one should not proceed in a hap-hazard manner to search for it, but should first orient himself with reference to known landmarks, such as the internal urethral orifice and interureteric ridge. If the inner end of the speculum is found to be resting on the ridge, the probabilities are that the speculum has been pushed in the bladder to the proper distance, and that the ureteral orifice will be found either laterally or medianward from the area first inspected. If the interureteric ridge is seen to lie at some distance beyond the end of the speculum, we know that the speculum has not been pushed far enough from the internal urethral orifice; whereas, if the ridge is nowhere in the field of vision, it is because the speculum has been pushed in too far. The experienced cystoscopist grasps these clues and readily corrects his first location; but for the beginner it is often a saving of time to withdraw the speculum to the internal urethral orifice and to again follow the prescribed routine."

Hunner calls attention to a second ridge in the bladder, which has not been mentioned by cystoscopists, and which may readily confuse the beginner. He calls this the vesico-uterine fold, as it corresponds to the vesico-uterine sulcus outside of the bladder. It is a transverse ridge or fold of the bladder mucosa, situated about 3 cm. back and running parallel with the interureteric ridge. It is most marked in women who have borne children, and in some very relaxed cases there are one or two small accessory ridges running parallel with the main vesico-uterine fold. Frequently one is led to the exact location of the ureter by seeing a spurt of urine even though the speculum may be at some distance from the orifice.

"The ureter generally enters the bladder on a papilla-like elevation of the mucosa, the so-called "mons ureteris." This, as already stated, is often more prominent on the left than on the right, and it is generally most developed in women who have borne children. In nulliparæ the mons is frequently absent, and instead of an elevation of the mucosa there may be a saucer-like depression. When the ureter is shortened from any cause, especially in the inflammatory thickening of tuberculosis, the orifice may be retracted. At times one finds a vessel circumscribing the ureteral orifice, or one or more vessels may radiate from the orifice not unlike the retinal vessels about the optic disc.

"Should the base of the bladder be the seat of inflammatory changes the ureteral orifice may be difficult to locate because of alteration in both the immediate and distant landmarks. One is sometimes compelled to hunt for the orifice with the ureteral searcher. The inflammatory swelling may interfere with the jet-like action of the urine;

but with a little patient watching one can generally catch the light-reflection as the urine spreads over the mucosa, and in this manner the orifice may be located without the use of the searcher. To collect urine from a kidney when for any reason it is undesirable to catheterize the ureter, we make use of the cystoscope with oblique distal end, such as originally shaped by Grünfeld. This can be held to cover the ureteral orifice more easily than the cystoscope with the ordinary square end."

Catheterization of the ureter is a simple matter after its orifice is located, and special rules are not necessary. If the hands are surgically clean, the renal catheter may be grasped at any portion; but if the hands are septic, the catheter must be grasped near its outer end at a point that is not to reach as far as the urethra with the catheter at full insertion. The renal end may be guided into the speculum by an assistant who handles it with sterile forceps. An assistant is not absolutely necessary, for the stilet stiffens the catheter sufficiently to enable the operator to handle it from the distal end.

If one wishes to grasp the catheter near the speculum and still be certain of a good technique, a rubber glove for the thumb and first two fingers is easily slipped on, and by keeping this already sterilized, powdered, and wrapped in a sterile towel, the operator can first locate the ureteral orifice, and then have the assistant draw the glove over his catheter hand, either right or left. It is well always to wear the head mirror over the eye opposite the hand used in catheterizing, to avoid touching the mirror with the catheter as it is pushed past the operator's head.—EDITOR.]

Bacteriologic Diagnosis.

The purpose for which bacteriology is employed in gynecologic diagnosis is to demonstrate certain specific micro-organisms in the tissues or in the secretions of the diseased organs. The bacteriologic examination is usually made with a microscope, cultures being resorted to only in exceptional cases.

Bacteriological methods of examination are employed under the following conditions:

1. For the Diagnosis of Gonorrhea. The gonococcus is found in the secretions of the diseased mucous membrane and also penetrates its substance. In practice demonstration of the micro-organisms in the secretions by means of characteristic staining methods is sufficient; demonstration of gonococci in the tissue is much less certain and, owing to the great danger of infection of the wound left by the excision, it is not to be recommended. A minute quantity of the secretion of the diseased membrane is obtained with the platinum loop and thinly spread on a cover-glass by drawing another cover-glass over it. The cover-slips are allowed

Gonorrhea.

to dry in the air and passed three times through the flame. The smear is stained with a watery solution of methylene blue, allowed to dry, and examined under the oil immersion lens. If many other bacteria are present, the Gram method of staining should be employed in order to differentiate the gonococci. This consists in placing the cover-slips in a solution of anilin water and gentian violet for half an hour, rinsing and staining for from three to five minutes in dilute Lugol solution (1:150), again rinsing in water, and placing the smears in absolute alcohol until they are completely decolorized. The gonococci are now completely decolorized and may be counter-stained with Bismarck brown, so that they form a distinct contrast to the other organisms, which are stained a dark violet.

Gonococci are diplococci which by division assume the shape of biscuits (rolls) or coffee beans; by further division groups of from

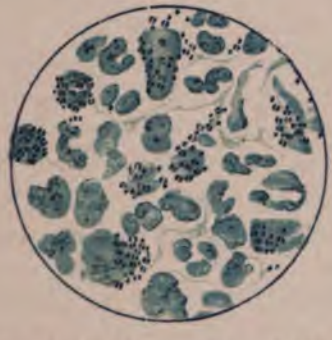


Fig. 31.—Gonococci in Pus. (Original.)

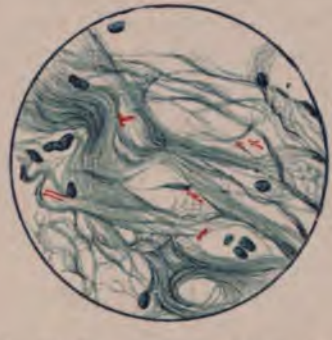


Fig. 32.—Tubercle Bacilli in Sputum. (Original.)

twenty to thirty double individuals are formed. The cocci are found in the leukocytes, on squamous epithelial cells, or rarely free in the secretion (Fig. 31). The diagnosis is based on finding the gonococci within the cells and on the positive Gram. Diplococci lying outside of the cells are more difficult to identify, and still more so are the involution forms.

Secretions which contain but few other bacteria, or none at all, are best adapted for the demonstration of gonococci. They are the secretion of the urethra and of the uterus, especially when the external os is contracted. Gonococci are most easily found in the vulvovaginitis of children before any treatment has been given. The vaginal secretion of adult women is useless for the purpose of demonstrating gonococci. Cultures are not employed for the diagnosis of gonorrhea.

Tuberculosis.

2. For the Diagnosis of Tuberculosis:—A bacteriologic diagnosis of tuberculosis can be made by demonstrating the tubercle bacilli, by making cultures, and by positive inoculation experiments.

The tubercle bacillus dwells chiefly in the diseased tissues, while it appears to be destroyed in a short time by the secretions of the genital organs. Occasionally it can be demonstrated with the microscope in the discharge from suspicious looking ulcers, in the secretion of the diseased uterus, and in the urine in tuberculosis of the bladder and kidneys.

The tubercle bacillus is identified by its characteristic shape and specific staining properties. The secretion to be examined is thinly spread on a cover-slip with the platinum loop, dried in the air, and fixed by passing it three times through the flame. The preparation is then covered with an excess of concentrated Ziehl's solution (1 gram of fuchsin in 10 grams of absolute alcohol and 100 grams of 5-per-cent. watery solution of carbolic acid) and slowly allowed to dry over the flame. The stain is then washed off with water, the smear decolorized in a 2.5-per-cent. nitric acid solution and, after thoroughly shaking in 60-per-cent. alcohol and again rinsing in water, counter-stained for one minute with a dilute watery solution of methylene blue. With an oil immersion lens the characteristic shape and intense red color of the tubercle bacilli, in contrast to the blue surroundings, are readily recognized (Fig. 32).

As tubercle bacilli very often do not remain long in the secretion, or are destroyed by the rapid growth of other bacteria, *their absence is never to be taken as a proof of the absence of tuberculosis.*

More positive information is afforded by *examination of the tissue*, because along with the bacillus itself the specific tissue reaction may be demonstrated. The following method of staining the sections, recommended by Cornet, is the most satisfactory. The sections are placed in a small dish containing Ziehl's solution and exposed for from one to twelve hours in a thermostat at a temperature of 37° C. They are then transferred to water, placed for an instant in 2.5-per-cent. nitric acid solution, and then in 60-per-cent. alcohol, which is repeatedly renewed. After thoroughly rinsing the sections in water, they are counter-stained with a watery solution of methylene blue and examined under the oil immersion lens. Even if the bacilli are present in such small numbers that they are not found, the characteristic tissue reaction may be recognized with this method of staining. The necessary tissue for the examination is obtained from the uterine cavity by an exploratory curettage or by excising suspicious looking ulcers of the vagina, the vaginal portion and vulva.

Making cultures is a difficult and time-consuming procedure, and is hardly applicable in ordinary practice; the same is true of inoculation, and these methods are practically employed only in very important cases which cannot be cleared up by simpler methods.

3. For the Demonstration of Pyogenic Microörganisms. Examination for pyogenic microörganisms, streptococci and staphylococci, is of importance in the differential diagnosis from gonorrhea and tuberculosis as causes of suppuration, and for the prognosis, in order to determine the virulence of the process. Pyogenic Microörganisms. The pus which is to be examined for these microörganisms is almost without exception derived from the adnexa, and is obtained by means of an exploratory puncture of abscesses, of pyosalpinx through the vagina, or by opening them in the course of operation. The object of the examination is to establish the prognosis of an operation in time, or to enable the operator to adapt his procedures to the kind of microorganism found. Free suppuration from the uterus, or a perforated abscess or pyosalpinx, interferes with the finding of the specific pyogenic microörganism because of the large numbers of saprophytes present.

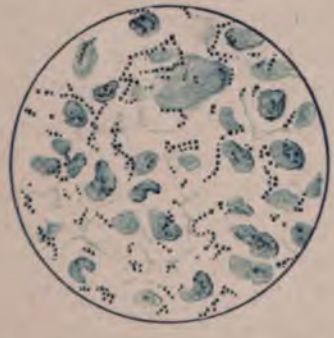


Fig. 33.—Streptococci in Pus. (Original.)

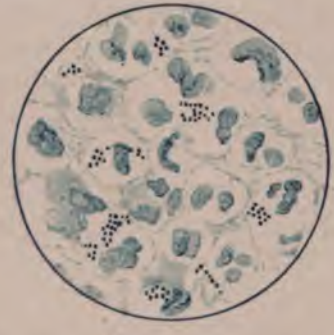


Fig. 34.—Staphylococci in Pus. (Original.)

For a microscopic examination a droplet of pus is obtained with the platinum loop at the time the abscess is opened, spread between two cover-slips, dried in the air, and stained with methylene blue. Streptococci (Fig. 33) appear in the pus usually as short chains of two to three individuals. Staphylococci are congregated in small groups of from three to ten (Fig. 34). The microscopic examination, however, frequently proves negative because the specific organisms are not sufficiently numerous to be demonstrable, or cannot be positively differentiated from other germs because they possess no specific tinctorial properties.

The more reliable method of identification is by means of cultures, which should always be employed if the diagnosis can wait a day or two. The simplest procedure consists in making a streak culture of pus on a slanting agar tube under aseptic precautions. After twenty-four to thirty-six hours' exposure in a thermostat a positive diagnosis can be made. If there is reason to believe that the organisms are few

in number, a preliminary culture should be made in sterile bouillon. After the medium has become distinctly turbid, a second examination is made with the microscope and with an agar tube, and a diagnosis is arrived at without difficulty.

The virulence of a suppurative process is best determined by intraperitoneal inoculation of white mice.

Bacterium coli, Pneumococcus, and Actinomyces rarely need to be demonstrated for a gynecologic diagnosis.

Radiography.

Examination by means of the Röntgen rays, which is employed as a supplementary diagnostic method in almost every branch of clinical medicine and has produced some radical changes in these methods, has added very little to gynecologic diagnosis. Our methods of investigation, especially combined palpation, are so complete that we rarely have occasion to clear up a doubtful condition by means of the Röntgen rays; and, on the other hand, the genitalia are so hidden in the pelvis, and the differences in the resistance which they offer to the passage of the rays are so slight, that we can rarely hope to obtain a satisfactory X-ray picture. It is only when the tissues to be investigated offer great resistance to the passage of the rays that a fairly distinct picture can be obtained; as, for example, in the case of the bones of an almost mature fetus; bones, teeth and calcareous plates in dermoid tumors and teratomata; the presence of calcification in fibromata and extra-uterine pregnancies; stones in the bladder, ureter and uterus; metal foreign bodies in the bladder and uterus. The technical difficulties are so great, however, that a diagnosis is possible only in exceptional and very suitable cases. The most promising field of radiography is the detection of foreign bodies (especially hair-pins) and vesical calculi, in which some noteworthy results have already been recorded.

[X-ray laboratories, in which physicians can take advantage of the use of radiography, are to be found in almost all large cities.—Editor.]

The Making of a Gynecologic Diagnosis.

There are two methods of making a diagnosis: the objective examination of the patient and the history. The latter is the older method and was formerly the only one at the physician's disposal. At the present time it still plays an important part among the older physicians, and in the hands of attentive observers and experienced practitioners gives very good results. During the past decades this method of diagnosis has been crowded into the background by direct examination of the diseased organs. Our methods of examination are in constant process of development, and in certain branches have reached such a

degree of delicacy that a positive diagnosis can be made without any interrogation of the patient whatever. The comparative importance of the two diagnostic methods varies in the different specialties and depends in general on the perfection of physical methods of examination. Ophthalmology, laryngology, and certain branches of internal medicine have the most accurate methods of examination; while other branches, such as psychiatry, are almost entirely dependent on the anamnesis.

Gynecology is one of the specialties which enjoys the advantage of very delicate methods of examination, and it owes the prominent position which it occupies at the present day most of all to the development of the combined examination. In the majority of cases a positive diagnosis can be made by combined examination without any aid from the history, and it should therefore occupy the first place in the construction of the diagnosis. Gynecologic diagnosis practically means the recognition of a disease of the genital organs from the results of combined examination. The physician's duty is double: to feel the changes and to interpret them correctly. The first is a matter of practice, which can only be acquired in special touch-courses and retained in one's subsequent practice. Without this constant subsequent practice the gynecologist will soon find that he has lost his touch, and with it the foundation of gynecologic diagnosis. The interpretation of the findings, on the other hand, is a matter of experience, and can be acquired only by constant opportunities to verify one's diagnoses. It is only since inspection of the diseased organs in the living subject at laparotomies has made this possible that gynecologic diagnosis began to make rapid strides; and it is now gaining in accuracy every year. Every gynecologist repeats in his own work the process of evolution of the signs of gynecology in general; for the more he operates, the greater will be his diagnostic skill. This avenue is closed to the general practitioner, and without the assistance of his teachers' experience he would never achieve the ability to make a positive diagnosis. This experience gives him the correct interpretation of his findings, and with it as a foundation he is enabled to develop himself in his daily practice. For this reason thorough instruction in gynecologic diagnosis by special touch-courses is absolutely necessary; but it must be accompanied and later supplemented in daily practice by the written page, and this is the real justification of this text-book of mine.

The interpretation of the findings should be as precise as possible, and should represent a clearly circumscribed pathologic conception. The physician must recognize a well characterized disease, and not rest content merely with determining the conditions present, or with a general confused mental picture of mere symptoms. Too often

the physician is satisfied if he feels a tumor, and makes no attempt, by more careful examination, to determine the nature of the tumor; or he dismisses his patient with a diagnosis of flooding, dysmenorrhea, menorrhagia and the like. These are mere symptoms and in no sense diseases, and such a diagnosis can only be followed by symptomatic treatment. In my teaching I have always endeavored to train my students in such a way as to make them diagnosticate a clearly defined pathologic condition, and I shall follow the same method in the section on special diagnosis.

It appears then that gynecologic diagnosis demands first of all a local examination. The physician must never allow personal considerations to interfere with such an examination, nor permit himself to be deterred by the patient, who will often try in every possible way to escape the much dreaded ordeal. A delayed examination in the case of uterine cancer, for example, may, by postponing the diagnosis, sacrifice the patient's life. There are few cases in gynecology in which the objective examination cannot be made the basis of the diagnosis; they are chiefly in young and unmarried women, and those who are excessively nervous and irritable. In such cases internal examination should if possible be dispensed with, because the psychic, nervous, and occasionally moral injury is greater than the advantage gained by a strictly objective diagnosis. Examination in such cases must be replaced by the anamnesis; if this gives no result, or the patient's statements point to a severe or a local trouble, demanding local treatment, an examination becomes imperative and should then be performed under anesthesia, which removes the above mentioned disadvantages of the examination and makes it much less difficult.

Anamnesis. Next to the objective examination, the interrogation of the patient for the purpose of ascertaining the symptoms has a certain importance for the diagnosis; but the symptoms should be utilized for making the diagnosis only when the objective examination fails to yield the desired result. For this reason the physician who is not perfectly sure of his ability to make an examination is constantly tempted to resort to the auxiliary method, and occasionally constructs from the symptoms a diagnosis which has no objective background whatever; whereas the practised diagnostician relies less on the symptoms the more confidence he feels in his examination. Nevertheless the symptoms cannot be dispensed with altogether in making the diagnosis, particularly in the recognition of those diseases in which the palpatory findings are uncertain or absent, such, for example, as endometritis; or when the objective findings are not sufficiently clear, as in extra-uterine pregnancy; or when the conditions found in different diseases are apt to be very

Anamnesis.

similar. The value of the information derived from the symptoms, however, is never very great, because gynecologic symptoms are all very much alike. Sensations complained of by the patient practically always follow the same direction: they complain of pain, hemorrhage, discharge, and a few other less important symptoms; hence it is not easy for the general practitioner to construct a picture of the disease from the symptoms. Not so, however, with the experienced gynecologist. He soon learns to distinguish between the sacral pain complained of in retroflexion of the uterus or posterior parametritis. He very soon learns, too, the diagnostic significance of the character of the different kinds of dysmenorrhea; not infrequently the character of the hemorrhages enables him to recognize the disease, so that, conversely, the cases are by no means rare in which he is able to make a diagnosis from the woman's statements without examining her. The general practitioner can hardly hope to attain such a degree of proficiency, and he is therefore earnestly warned not to attempt such methods, as they frequently lead to a mistaken diagnosis.

On the other hand, the symptoms complained of by the patient unquestionably assume much greater importance when it becomes necessary to bring them in accord with the genital disease which has been diagnosticated by means of an objective examination. A diagnosis cannot be called exhaustive or complete unless all the symptoms complained of can be readily explained by the local disease; if they are not fully explained, it must be assumed that the affection which has been demonstrated is not the only disease present, or that it represents merely a comparatively indifferent secondary condition. This may be explained by an illustration: Suppose the physician has demonstrated by means of a combined examination enlargement of the uterus to the size of a fist from the presence of interstitial myoma, and the patient complains only of profuse menstruation coming on ahead of time, with intense dysmenorrhea before and during the bleeding; the symptoms can be referred to the myoma and the case is clear. But suppose the woman complains in addition of constant dragging and burning pain in the left side of the abdomen, especially while walking, during physical labor, or sexual intercourse. In such a case there is a strong probability that there are, in addition, inflammatory foci in the left parametrium or in the adnexa, and the presence of such foci must therefore be determined by an examination. It happens quite frequently that symptoms referable to disease of the liver, stomach or kidney are commingled with the symptoms of disease of the lower abdomen and complicate the clinical picture. For this purpose an objective examination to explain the symptoms cannot be too minute.

Finally, an accurate knowledge of the symptoms may be necessary in many cases in order to form a basis for the treatment, particularly when the symptoms cannot be removed by radical treatment of the disease.

In addition to the symptoms the etiology of the disease and its previous course must receive attention in taking the history.

The general practitioner is usually not inclined to attach much weight to this portion of the anamnesis; he contents himself with the diagnosis and treats the patient accordingly. While it is true that it chiefly affects the scientific aspect of the case, nevertheless valuable information for the prognosis and treatment of the case is quite often gained by careful attention to these points. For example, it is not immaterial whether in the course of a tubal tumor there have been several attacks of peritonitis, whether a parametritic exudate is puerperal or due to gonorrhea—and these facts can be determined only by the anamnesis. An attempt should be made in taking the history to determine the time when the symptoms began and to find an intelligible cause. The causes of gynecologic affections are found principally in confinements, the puerperium, injuries sustained during menstruation, sexual infection, and occasionally in the mode of life, occupation, and domestic surroundings. Sometimes, depending on the special character of the disease, the physician may be called upon to invade quite different fields in his investigations. Questions in regard to the family history are practically never necessary, and the history during childhood is very rarely required. It is also usually superfluous to ascertain in every case the character of the menstruation, the histories of previous confinements or even of some internal disease which the patient may have had in earlier life, unless the gynecologic disease has its origin in such a condition, in which case the connection must be established as clearly as possible.

Technique of History-taking.

It follows from what has been said that interrogation of the patient, while it has but limited importance in making the diagnosis, nevertheless plays a very important part in enabling the physician to form a general idea of the character of the disease. For this reason it does not seem to me superfluous to touch upon certain points which may materially change the value of the data obtained from the history. To begin with, it is almost needless to say that we are obliged to touch upon a number of points of a very delicate nature. The woman's native modesty will in most cases keep her from volunteering information on matters which belong to married life and sexual intercourse; but the physician cannot always avoid mentioning such points, and in doing so, he should therefore spare the woman's feelings as much as possible. We must constantly bear in mind the possible effect of our questions if we wish to avoid arousing the woman's sus-

picion and producing a condition of psychic unrest. It is incredible what a variety of meanings an anxious patient may discover in the simplest question put by the physician. We must also be constantly on the lookout for deception on the part of the patient, intentional or unintentional, in order to avoid being led astray. As we are obliged in our specialty to uncover both marital and non-marital sins, we do not often obtain truthful information on these points. It must also be remembered that a careless word on the part of the physician in regard to infection may undermine the happiness of a household. The rock on which the anamnesis is most frequently wrecked is the character of the woman herself. Woman is such a vacillating creature, influenced by all kinds of external impressions, so much dependent on feeling and caprice, that she is frequently unable to give a clear account of anything. In many women the physician's questions produce such a degree of excitement that they are hardly able to speak, let alone give correct answers. Women as a rule are not much given to precise utterance and still less to accurate self-observation. On the other hand, many women are endowed with such an excess of feeling that we must be on our guard not to mistake their sensations for symptoms. The physician must make due allowance for these feminine characteristics. Fortunately it is possible to influence them in a very marked degree. A short, brisk manner intimidates the patient and excites her; restlessness and nervousness on the part of the physician are at once communicated to the patient; while, on the other hand, an equable and amiable manner tends to quiet her agitation. By persistent interrogation one can always succeed in getting the woman to answer in the manner desired. Taking everything into consideration, it is therefore no easy matter to obtain a satisfactory history. I have always found it better not to ask too many questions, because a woman is always tempted to give the answers that the doctor appears to expect. It is better to let her tell her own story. An experienced practitioner can glean what he needs from the patient's statements; if she digresses she must be brought back to the point. While listening to her story one has an opportunity to form an idea of the patient's character and of the psychic and nervous condition.—Finally, the question *when* the history should be taken remains to be considered. In general it should precede the examination as in other departments of medicine, and for the general practitioner this method is necessary, if only to enable him to recognize the case as a gynecologic one. But even the specialist will find it better to begin by taking the history, so as to quiet the patient by conversation and learn what direction his examination should take; otherwise he may be obliged, much to his discomfiture, to begin all over again. As female patients often have the unpleasant

habit of forgetting or concealing the most important points, the physician should first direct his questions to the function of the chief organs. During the examination the findings will suggest other questions and, after the examination has been completed, the case can be cleared up in every direction by completing the history.

Observation of the Patient. Not infrequently the practitioner will be unable, in spite of all diagnostic methods and of a carefully taken history, to arrive at a definite diagnosis. Unless he prefers to seek the assistance of a more experienced adviser at once, this will force him to keep the patient under further observation, and to content himself for the time being with expectant treatment. Subsequent observation brings with it repeated examinations and thus the case is frequently cleared up. A more important point, however, is that changes sometimes develop in the disease in the course of time which help to explain findings that were previously doubtful. For example, it is often very difficult to make a differential diagnosis between a myoma and an intra-ligamentary exudate. Keeping the patient under observation for a few weeks will suffice to bring out changes in the consistency and shape of the tumor due to absorption, and the diagnosis of an exudate is no longer doubtful. An important point to bear in mind in keeping the patient under observation is that she shall not suffer any injury through postponing the diagnosis. Observation, for diagnostic purposes, of cases that suggest malignancy, whether at the cervix or in the abdomen, is not permissible. Formerly it was a well recognized practice to keep a suspicious ulcer in the vaginal portion, for example, under observation. The observation was continued until malignant degeneration was definitely determined. Nowadays this is a technical error, because the delay renders the carcinoma inoperable. If there is the slightest suspicion of malignancy, other means must be employed to arrive at an immediate diagnosis. With the exception of these cases, very good diagnostic results are often obtained by keeping the patient under observation. In inflammatory diseases absorption brings about characteristic changes in the shape and consistency of the mass; in the case of doubtful tumors of the adnexa observation in time demonstrates that the tube forms the nucleus of the tumor. In small ovarian tumors the subsequent growth frequently decides between retention-cyst and neoplasm; in extra-uterine pregnancy weeks are often required to clear up the question whether the gestation-sac is still growing or the ovum has already perished; in doubtful cases of intra-uterine pregnancy the diagnosis is often confirmed only by continued observation; and, finally, in pregnancy with a dead fetus, subsequent observation of the uterus is the only means of arriving at an absolutely definite diagnosis. Observa-

Observation of the Patient.

tion of the patient is occasionally combined with certain methods of treatment which lead to a diagnosis ex juvantibus, such as absorbent treatment of inflammations and antisyphilitic treatment in cases of doubtful processes on the vulva.

The General Condition. Gynecologic diseases are in the main local in character and represent local reactions to irritants which affect the genitalia during parturition or during menstruation as a result of infection, etc. The diagnosis accordingly is in most cases confined to local changes. Not infrequently, however, gynecologic symptoms develop in the course of general diseases and owe their existence to the general disease and not to a local affection; as, for example, pruritus in diabetes; menorrhagia in diseases of the heart, kidneys, and blood; flooding in chlorosis; amenorrhea in tuberculosis. In such cases the physician is consulted on account of the gynecologic trouble, and this leads him to discover the general disease. If no other local cause can be found for a gynecologic symptom, a general disease must be looked for.

General Condition.

The patient's general condition, however, is of even greater importance for determining the effects of the local abdominal disease on remote organs and on the entire organism. Such sequelæ are so frequent in women, and often so severe that the physician is bound not to neglect them. Examples are the general anemia which occurs in endometritis, uterine cancer with hemorrhages, and in severe catarrh; chronic toxic states, manifesting themselves as general weakness and loss of nutrition, which follow diseases that lead to the formation of toxins, such as carcinoma, pyosalpinx, purulent exudates, infectious purulent catarrh, and the like. Whenever the case at the first glance does not declare itself as a purely local process, the patient must be interrogated concerning the functions of the vital organs—heart, stomach, intestines—and if any symptoms referable to these organs are complained of, they must be subjected to a thorough examination. In most cases when distant organs and the general condition are affected, it is due to nervous influences; and it is not always easy to discover in these cases the connection with the local abdominal disease. Still less clear is the connection with gynecologic diseases in the case of general nervous conditions such as neurasthenia, hysteria, and psychoses. In any case the greatest conservatism in this respect is to be recommended, because the treatment of a gynecologic affection, under the false impression that it is associated with a neurosis, may do a great deal of harm.

Special Diagnosis.

The Normal Findings.

BEFORE beginning the special diagnosis of gynecologic diseases, the normal findings will be described because they must form the foundation for the interpretation of pathologic conditions in the female genital organs—the topographic anatomy for the palpatory diagnosis, and the histology for the microscopic diagnosis.

Topographic Anatomy of the Female Genital Organs. Normal Palpatory Findings.

The external genitalia (vulva) consist of the labia majora and minora, the clitoris and vestibule, and are separated from the vagina by the hymen.

Vulva.

The labia majora (labia pudenda majora) are two thick folds of skin, smooth on their internal surface and covered on the outer with epidermis; they unite in front by the anterior commissure and merge with the skin of the mons Veneris, which contains a thick pad of fat. Posteriorly the frenulum, a thin fold of skin, is stretched between the two labia, and behind the frenulum is the beginning of the perineum, which extends to the anus; while beyond it is the posterior perineum (Hinterdamm), reaching as far as the sacrum. In nulliparous women the labia majora approach each other so closely as to expose only the anterior margins of the labia minora; while in multiparæ, owing to the lacerations of the posterior commissure and relaxation of the vaginal walls, the greater labia are widely separated, leaving the entrance to the vagina freely exposed. The mons Veneris, the outer surfaces of the labia majora, and the perineum as far as the anus and beyond, are covered with pubic hair in persons who have attained their sexual maturity. The upper boundary of the pubic hair represents a sharply defined horizontal line; while posteriorly it is gradually lost in the folds of the anus (crena ani).

The labia minora are two thin folds of mucous membrane of varying length; in some cases only the anterior margin, in others a large portion of the structures projects between the greater labia. The labia minora merge with the inner surfaces of the labia majora at about their middle. Drawing the labia majora apart brings into view the clitoris, almost completely covered by the prepuce, a flaccid, movable fold of skin covering all but the tip of the clitoris. The frenulum takes

its origin at the lower surface of the clitoris and divides into two portions, which diverge in a downward direction and merge with the labia minora. Above, the prepuce comes in relation with the labium minus on each side, so that the upper extremity of the latter on each side arises from one-half of the frenulum and prepuce, which embrace the clitoris between them.

By separating the labia minora the vestibule (vestibulum vaginæ) is brought into view. This is formed by the inner wall of the lesser, and adjoining portion of the greater labia, and in front by the clitoris and the divided frenulum. Posteriorly the vestibule is sharply divided from the perineum by the transverse frenulum. That part of the vesti-

Fig. 35.—Introitus in a Nulliparous Woman After the First Coitus. (Original.)

bule which forms a depression behind the frenulum is known as the fossa navicularis. The vestibule in front contains the opening of the urethra, immediately in front of the entrance to the vagina; on each side of the urethral orifice are two small, shallow depressions, and below the external orifice of the urethra a few small, barely visible ducts in the mucous membrane, which are occasionally permeable for a short distance to a thin sound (Skene's ducts). On the lateral wall of the vestibule, about 1 to 1.5 cm. in front of the posterior median line, outward alongside the hymen on each side, is found a very small opening, the duct of Bartholin's gland, which sometimes admits a very small sound.

The vestibule is separated from the vagina by the hymen, an almost circular fold of mucous membrane, which begins at the external orifice of the urethra as a narrow ridge and gradually becomes higher

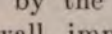
as it passes backward. The hymeneal opening in a virgin is thus situated eccentrically in front, and its size depends on the height (width) of the hymen. At the first coitus the hymen is ruptured (sometimes the membrane is only stretched), usually bilaterally down to the base, forming three flaps or folds, a larger median, and two smaller lateral segments (Fig. 35). In multiparæ the remains of these segments are seen in the form of a few papillary elevations (carunculae myrtiformes) (Fig. 36). If the hymen is intact, the interior of the vagina cannot be seen; but when the hymen is ruptured, the lower segment of the anterior vaginal wall, and rarely the posterior, is exposed; in a multipara the vaginal mucous membrane at the introitus is arranged

FIG. 36.—INTROITUS OF A MULTIPARA. (Original.)

in small folds. As the result of old perineal lacerations the introitus becomes still more enlarged. The lacerations destroy the anterior portion of the perineum and the frenulum, obliterating the fossa navicularis, and extend to the left or right from the median line into the posterior vaginal wall, so that the columna rugarum posterior is drawn over to the other side by its own elasticity. If the lacerations involve both sides of the vagina, the posterior wall (columna rugarum posterior) is prolapsed and hangs down like a tassel.

This completes the inspection. The examination of the vagina requires the introduction of the finger, while the vaginal wall is studied with a speculum.

The **vagina**, when the bladder and rectum are empty, runs from before backward, approximately parallel with and slightly below the antero-

posterior diameter of the pelvic outlet; it forms a muscular tube about 8 cm. in length and is exceedingly variable in width. The anterior wall is in contact with the posterior, while the lateral walls form short connections between the two, so that the cross-section is represented by the following figure  . In the lower half of the anterior wall, immediately below the symphysis, is seen the prominence formed by the urinary meatus; about the middle of the anterior wall the prominence diminishes and gradually disappears altogether (columna rugarum anterior). The posterior wall also contains in its lower half a somewhat smaller median prominence (columna rugarum posterior). From these two prominences transverse folds and wrinkles are given off on each side; these are most distinct in a nullipara, but rarely absent altogether even in women who have borne children, while the upper half of the wall is smooth. Above, the vagina is closed by the dome-shaped vaginal vault. The anterior wall is in intimate relation below with the urethra and above with the bladder. The posterior wall is firmly attached below to the perineal tissue, while the median third is loosely connected with the rectum, and the upper third also loosely conjoined with the peritoneum of Douglas' space. The lateral walls of the vagina are surrounded by the pelvic connective tissue. The vaginal walls, when moderately firm, are quite tense and firmly attached to the subjacent tissue. The state of the adjoining organs, whether full or empty, greatly influences the position of the vagina; when the bladder is full, the anterior vaginal wall, and when the rectum is distended, the posterior wall, protrudes into the lumen of the vagina. Above, in the vaginal vault, lies the vaginal portion of the cervix.

Vagina.

The superficial layer of the squamous epithelium which covers the vaginal wall is in a more or less constant state of desquamation, so that the walls of the vagina are constantly covered with whitish masses of epithelium. The color of the mucous membrane varies with the degree of vascularity. Under ordinary circumstances the color is pale red, and the membrane glistens.

The **portio vaginalis** is that portion of the cervix which projects into the vagina; it is situated behind the pelvic axis*; about 1½ to 2 finger-breadths in front of the tip of the sacrum, at the level of a line between the two spines of the ischium; as a rule it occupies the median line, but lateral deviations not infrequently occur when the

* The pelvic axis (curve of Carus) is a line running through the middle of the pelvic canal parallel with the anterior surface of the sacrum (Fig. 37).—The words "right" and "left" always refer to the right and left side of the patient. The terms "in front" and "behind" refer to a patient in the standing position; hence the anterior surface in the erect position corresponds to the upper surface in the recumbent position.

body of the uterus lies obliquely in the pelvis. At the apex of the vaginal portion is the external os, which in a nulliparous woman forms a narrow transverse cleft in the anteroposterior direction (Fig. 38). After the first delivery slight lacerations remain, which increase the width of the external os (Fig. 39), sometimes so much so that the tip of the finger can be inserted into the lower portion of the cervical canal; thus the vaginal portion is divided into two lips. The cervix is surrounded by the vaginal vault in such a manner that the posterior lip is about twice as long as the anterior, and the supravaginal portion of the cervix is accordingly longer in front than behind. This makes the anterior vault appear flattened, while the posterior seems higher and more dome-like. The mucous membrane of the vaginal portion has a purplish-red color and is tightly stretched over the cervical tissue without forming wrinkles. The mucous membrane, which is exposed when the external os gapes, has an intensely red color and exhibits the oblique folds of the so-called arbor vitæ. The boundary between the mucous membrane of the vaginal portion and the cervix in a nulliparous woman is exactly at the external os; in multiparæ this boundary is displaced in every direction, so that the mucous membrane of the vaginal portion sometimes extends into the lower portion of the cervical canal, while, on the other hand, the red cervical mucous membrane may appear on the outer surface of the vaginal portion. These slight deviations from the normal are not to be regarded as pathologic.

Portio Vaginalis.

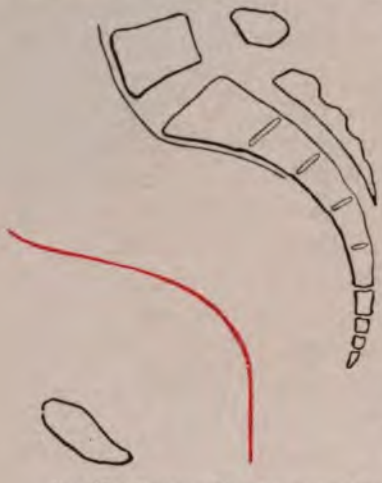


FIG. 37.—SAGITTAL SECTION THROUGH THE PELVIS WITH PELVIC AXIS (curve of Carus). ½. (Original.)

The healthy cervical mucous membrane constantly secretes a small quantity of glairy mucus, which becomes intimately mixed with the squamous epithelium desquamated in the vagina and forms the normal secretion of the genital apparatus.

The **uterus** is approximately pear-shaped and slightly flattened from before backward. Below the middle of the organ, in the region of the internal os, there is a slight constriction, and from that point down to the cervix the circumference of the uterus diminishes. The part above the constriction is the body of the uterus (corpus uteri); the portion of the body situated between the openings of the Fallopian tubes is known as the fundus uteri. The size

Uterus.

of the uterus varies considerably within normal limits. It is greatest in multiparous women during sexual maturity; considerably smaller in all dimensions in nulliparous women; and still smaller in old women. The measurements in a sexually mature woman are: distance between the two tubes about 5 cm.; thickness of the body about 3 cm.; distance from the fundus to the external os about 9 cm. The length of the cavity in a sexually mature uterus is 7 cm.; in nulliparæ, often somewhat less; in old women, 5 cm. The normal uterus is hard and unyielding and cannot be indented with the finger; in the region of the internal os, however, it has a certain softness and flexibility. When the bladder is empty, the body of the uterus lies on the upper wall of the bladder, while the fundus reaches almost to the posterior wall of the symphysis, the highest point of the body being below the plane of the pelvic inlet (Fig. 40). The body is usually situated exactly in the middle line,

FIG. 38.—VAGINAL PORTION OF A NULLIPARA. (Original.)

FIG. 39.—VAGINAL PORTION OF A MULTIPARA. (Original.)

although slight deviations to one side or the other are quite common. In such a case the corpus is displaced to one side and the vaginal portion to the other. The body forms with the cervix an obtuse angle, which is usually about 135°, but is subject to individual variations which have no significance. The normal uterus is movable within wide limits. When the bladder is full, the body is first elevated and then the entire uterus is forced against the posterior pelvic wall, and at the same time a little to one side and upward. When the rectum is full, the cervix is displaced downward and to the other side, *i.e.*, usually to the right. When the ampulla of the rectum is greatly distended with fecal matter, the entire uterus is displaced upward and to the other side. These abnormal positions disappear and are replaced by the above described normal conditions when the bladder and rectum are evacuated.

The body of the uterus is covered with peritoneum except along the lateral aspects. In front, at the level of the internal os, the peritoneum passes from the upper wall of the bladder to the uterus, forming

the anterior reflection or fold, and covers the anterior surface of the body, the entire fundus, and the entire osterior wall. Here it is

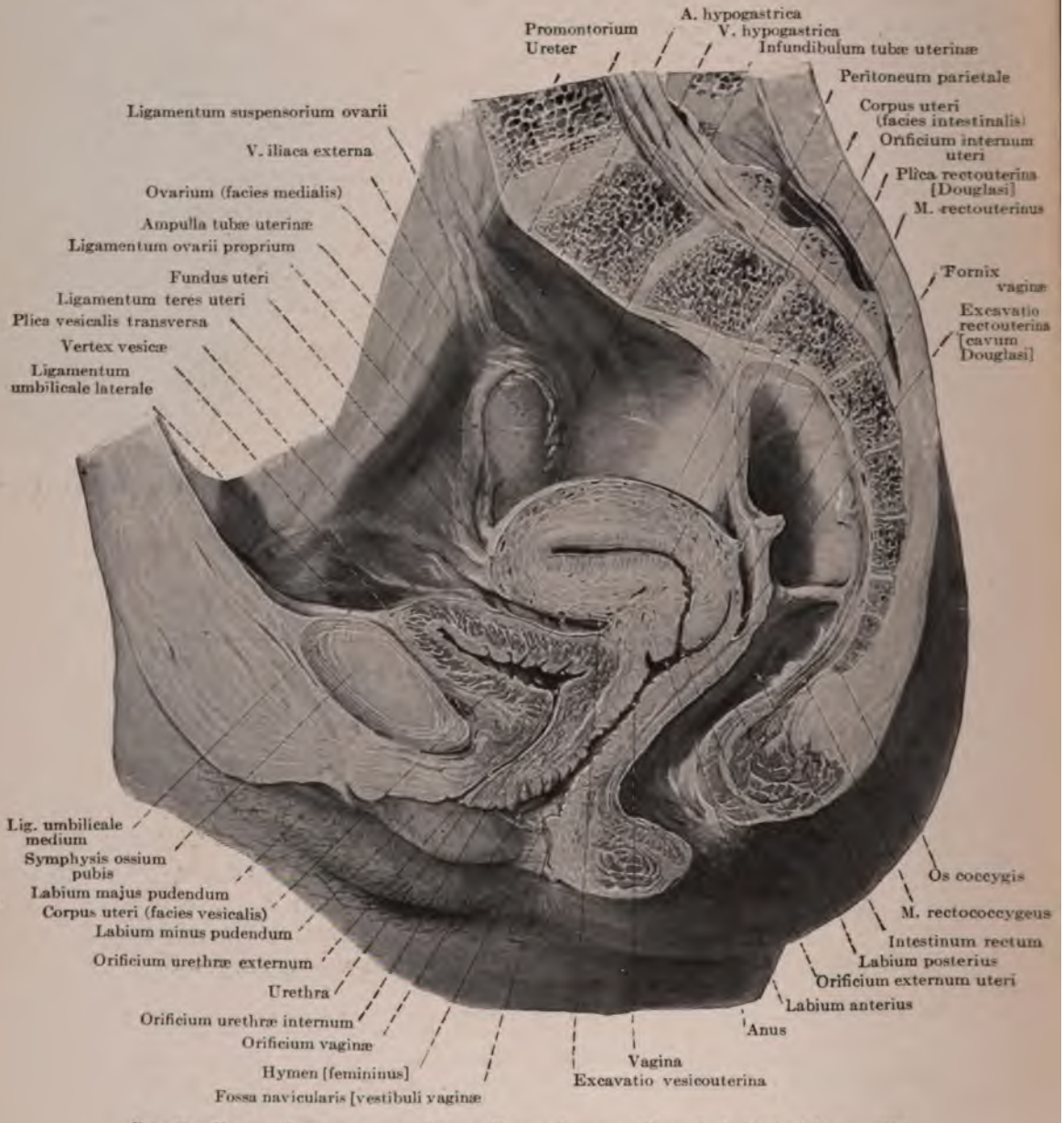


FIG. 40.—MEDIAN SECTION OF THE FEMALE PELVIC ORGANS. (From Spalteholz's Atlas, p. 601.)

depressed more than in front, covers the upper third of the posterior wall of the vagina, and forms the posterior reflection or fold, passing to the posterior pelvic wall of the rectum and merging with the peritoneum

of the posterior abdominal wall. In this way there is formed in front, between the bladder and uterus, the vesico-uterine pouch; behind, between the uterus and the posterior pelvic wall or rectum, is the recto-uterine pouch or Douglas's space, the lowest point of which is situated about at the junction of

Peritoneum.

FIG. 41.—SHOWING THE UTERUS WITH ITS COVERING OF PERITONEUM AND LIGAMENTS; ANTERIOR VIEW. (From a preparation in the Berliner Kgl. Universitäts-Frauenklinik.) (Original.) The dotted line indicates the boundary between the firm and loose attachments of the peritoneum. ½.

the middle and upper thirds of the vagina. The vesico-uterine excavation represents a mere cleft when the uterus lies on the bladder. The lowest portion of Douglas's space is also cleft-shaped; while above, the space is mostly filled with coils of intestine. The peri-

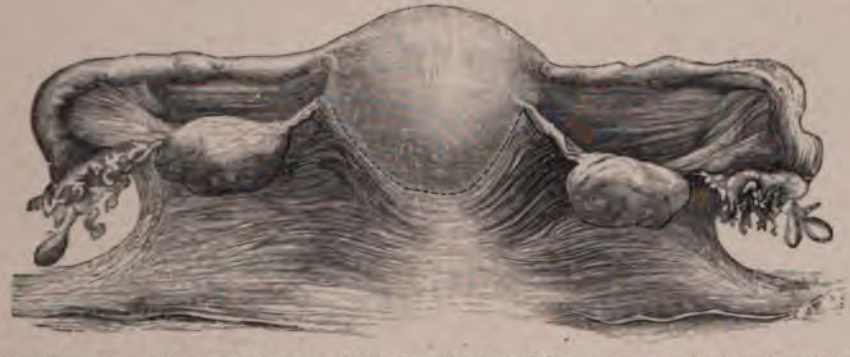


FIG. 42.—THE SAME; POSTERIOR VIEW. (Original.) The dotted line represents the boundary between the firm and loose attachments of the peritoneum. ½.

toneum is inseparably united to the fundus and adjoining portions of the body, while its connection with the lower portion of the body is quite loose, owing to the connective tissue intervening between it and the uterus. In front the boundary between the closely adherent and loosely attached peritoneum forms a flattened curve with the convexity directed downward; posteriorly it forms a spur which extends down to the posterior surface of the cervix (Figs. 41, 42). It follows from this

relation of the peritoneum to the uterus that extraperitoneal neoplasms, exudates, or hematomata may separate the peritoneum from the uterus and form extensive adhesions with the uterine wall.

The lateral aspects of the uterus are not covered with peritoneum. Here the two layers which cover the anterior and posterior walls of the

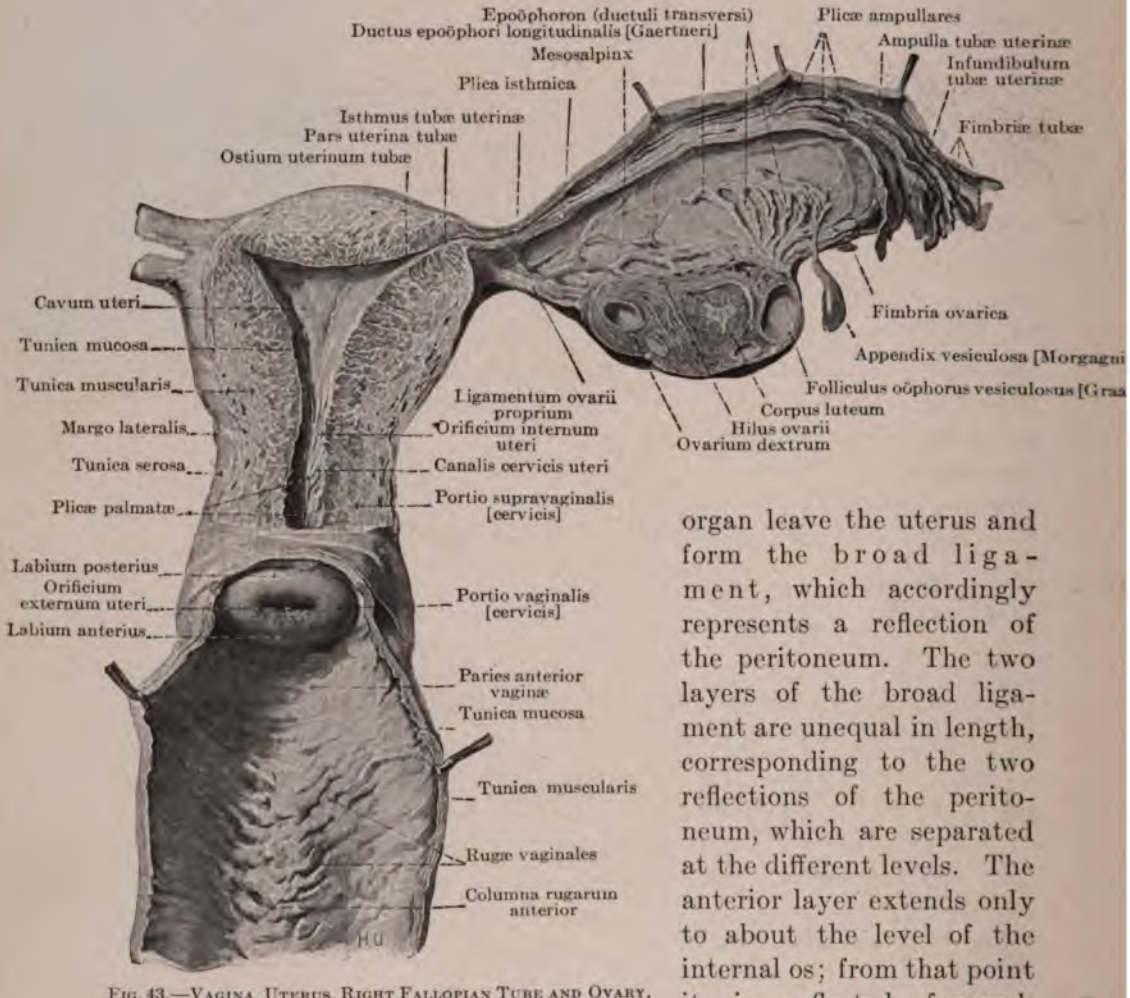


FIG. 43.—VAGINA, UTERUS, RIGHT FALLOPIAN TUBE AND OVARY. (From Spalteholz's Atlas, p. 598.)

organ leave the uterus and form the broad ligament, which accordingly represents a reflection of the peritoneum. The two layers of the broad ligament are unequal in length, corresponding to the two reflections of the peritoneum, which are separated at the different levels. The anterior layer extends only to about the level of the internal os; from that point it is reflected forward, passes to the anterior pelvic wall, and merges with the peritoneum of the anterior abdominal wall. The posterior layer descends much more deeply into the pelvis, joins the lateral lining of the recto-uterine excavation, and as such descends to the apex of Douglas's space. The upper portion of the broad ligament terminates laterally in a free border, which extends from the infundibulum tubæ, passing by the ovary, to the pelvic wall, and merges with the parietal layer of the peritoneum on the ileo-psoas muscle; this is

known as the infundibulo-pelvic ligament (Figs. 41–42). In the erect posture the median portion of the broad ligament corresponds to the anteverted position of the uterus and occupies the horizontal plane. In the lateral portion of the broad ligament, between the abdominal extremity of the tube and the ovary, is the epoöphoron, a collection of small canaliculi the longest of which is usually convex, with the convexity presenting upwards and running from the infundibulo-pelvic ligament to the ovary; while the remaining canaliculi, about 8 to 10 in number, pass from the inner surface of the ligament parallel to the outermost portion of the ovary (Fig. 43). The canaliculi are the remains of the Wolffian duct and the tubules of the primitive kidney. To the median side is the small paroöphoron, a small aggregation of canaliculi also derived from these embryonal structures.

The round ligments are two muscular cords about the thickness of a pencil, which arise from each side of the fundus immediately in front of the tube, pass in a curved line between the two layers of the broad ligament, and extend first to the lateral and then to the anterior abdominal wall (Fig. 41). From this point they pass downward and enter the internal ring and, traversing the inguinal canal, emerge from the external ring and are lost in the subcutaneous cellular tissue of the labia majora.

Round Ligaments.

The sacro-uterine (recto-uterine) ligaments, or folds of Douglas, are two flat peritoneal folds which separate from the posterior layer of the broad ligament at the point where it merges with the lateral wall of Douglas's space. They extend from the region of the internal os to the anterior sacral wall, where they are lost at the level of the second or third sacral vertebra. Behind the cervix they frequently unite to form a loop (Fig. 46). The folds of Douglas contain firm connective tissue and smooth muscle fibres (M. retractor uteri, Luschka).

Folds of Douglas.

Palpation of the Uterus. After the finger has been introduced into the vagina it is rotated so that the volar surface is directed upward and passed into the anterior vaginal vault, or—a still better procedure for fixing an easily movable uterus—the index finger is introduced into the anterior vaginal vault and the middle finger placed against the vaginal portion of the cervix or into the posterior vaginal vault. The external hand, with the fingers slightly flexed, is placed on the abdomen, about three finger-breadths above the symphysis, with the finger tips directed toward the umbilicus. This brings the uterus between the internal and the external hand (Fig. 3). Without moving the internal fingers the abdominal wall is slowly depressed with the external hand, and if the uterus is in its normal position it will then be felt between the fingers; if not, the fingers of the two

Palpation of the Uterus.

hands will come together. The beginner at first merely receives the impression of a firm resistance at the site of the uterus; but if he will

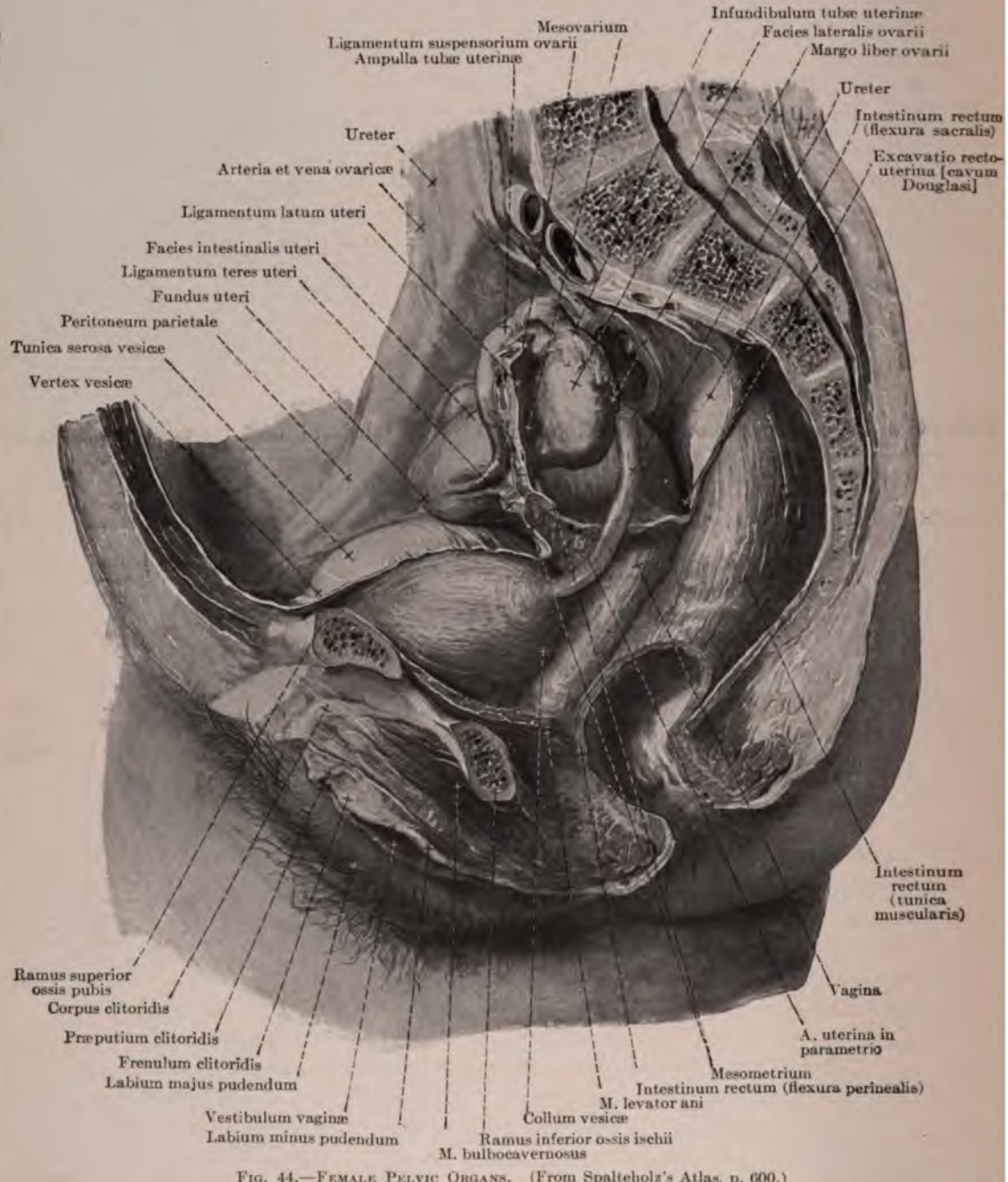


FIG. 44.—FEMALE PELVIC ORGANS. (From Spalteholz's Atlas, p. 600.)

keep his fingers on the uterus for a while, and palpate in various directions,—in front, to each side, and toward the vaginal portion—he will

recognize the organ by its shape and its connection with the vaginal portion of the cervix. The shape, the surface, and the size of the uterus should be noted; also the consistency, which is to be regarded as normal if the uterus is so hard and unresisting that it cannot be indented with the finger; next, the position of the uterus is determined, and finally its mobility. The uterus, which is surrounded by normal connective tissue and peritoneum, is movable in all directions, *i.e.*, it can be drawn towards the symphysis, pushed into the hollow of the sacrum, displaced towards the lateral pelvic wall, elevated along with the fundus to a point about half way between the umbilicus and the symphysis, and displaced so far downward that the vaginal portion of the cervix almost reaches the introitus. These movements, which can be performed without causing any marked pain, incidentally serve to test the elasticity of the ligaments. The two broad ligaments by means of their elasticity maintain the uterus in the median line; the round ligaments keep the fundus forward; and the function of the sacro-uterine ligaments is to prevent the cervix from dropping forward and downward.

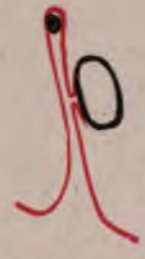


FIG. 45.—OVARY AND BROAD LIGAMENT. (Original.)

Palpation of the Ligaments. Only the round ligaments and the sacro-uterine ligaments, which are reinforced with muscular tissue, are accessible to palpation. The broad ligaments, unless they are thickened from pathologic deposits, cannot be felt. As a rule, however, the round ligaments are not felt because they are not sufficiently stretched and because the intermediate segment is completely embedded in the broad ligament. On the other hand, if the uterus is enlarged (myoma) and elevated above the pelvic inlet, the round ligaments can be palpated at the point where they are inserted into the uterus by passing the external hand along the lateral aspect of the uterus in a direction perpendicular to the course of the ligaments. In the same manner the part situated near the horizontal ramus of the pubis can be felt by making firm pressure with the external hand and passing it up and down in a direction perpendicular to its course. The recto-uterine ligaments can only be palpated with any degree of certainty through the rectum. One finger is introduced through the fold of Kòhlrausch and, by lateral and anterior movements, the ligament, which is usually curved, can readily be felt, especially if it is placed on the stretch by forcing the uterus forward. If the ligaments cannot be reached with one finger, the uterus is brought nearer by drawing the cervix down with a double tenaculum; or two fingers are introduced into the rectum under anesthesia.

Palpation of the Ligaments.

The **ovaries** are almond-shaped organs about 4 cm. long, 2 to 2.5 cm. broad, and 1 to 1.5 cm. thick. Their size is subject to certain variations, due to maturation of the follicles and the formation of corpora lutea. The ovaries are situated near the lateral wall of the true pelvis, immediately beneath the linea arcuata. The upper pole does not reach quite to the iliac vessels, while the lower just fails to touch the floor of the pelvis. They are freely suspended in such a way that the largest diameter is parallel to the long axis of the body; the hilus is directed forward, the free convex border backward, and the lateral surface almost comes in contact with the pelvic wall. The ovary is attached in two directions: the inferior, uterine pole gives off a firm, round fibrous band, the ovarian ligament, which is from 2 to 3 cm. in length, situated between the two layers of the broad ligament, and inserted in the lateral aspect of the uterus immediately below the tube (Fig. 42). Above, the infundibulo-pelvic ligament passes over the upper pole to the pelvic wall; the lateral portion of the infundibulo-pelvic ligament, which suspends the ovary to the pelvic wall, is also called the suspensory ligament of the ovary (Figs. 44 and 46). The ovary is not covered with peritoneum, being attached to the posterior layer of the broad ligament by a reflection of the peritoneum, about 3 to 5 mm. wide, known as the mesovarium (Figs. 42 and 45), so that only the portions of the ovary immediately adjacent to the hilus are covered with peritoneum. If the uterus is placed very obliquely, the ovary is found on the side toward which it is displaced, a little farther back; while the other ovary is drawn more toward the middle of the pelvis.

Ovaries.

The ovaries may be most easily palpated through the vagina. In order to find the left ovary, the left vaginal vault is forced toward the linea arcuata with the internal fingers, which are bent outward and upward, and the external hand—with slightly flexed fingers—is placed on the abdomen a little to the inner side of the internal hand; both hands are then brought together. In this way the ovary is usually found at the first attempt. It is recognized as an oval body of the size mentioned, and of firm, but not hard consistency. The ovary is very movable and easily slips from between the fingers—a point of great importance in diagnosis. As a rule, the ovary is very sensitive to moderate pressure.

Palpation of the Ovaries.

If the ovary is not found at the place indicated, the corresponding half of the pelvis must be carefully searched by passing the fingers in close contact, as described, up and down from behind forward. The fingers must be kept constantly in contact, otherwise the ovary will slip through without being noticed. It is not difficult for a practised examiner to find the ovary by starting at the cornu of the

uterus and following the tube or ovarian ligament, as either of these must eventually guide him to the ovary. The right ovary is also palpated with the left hand. The wrist is strongly depressed, the finger tips of the internal hand are raised, and the hand at the same time is slightly rotated outward; the search is made chiefly with the finger tips. Although the position of the hand is somewhat more inconvenient

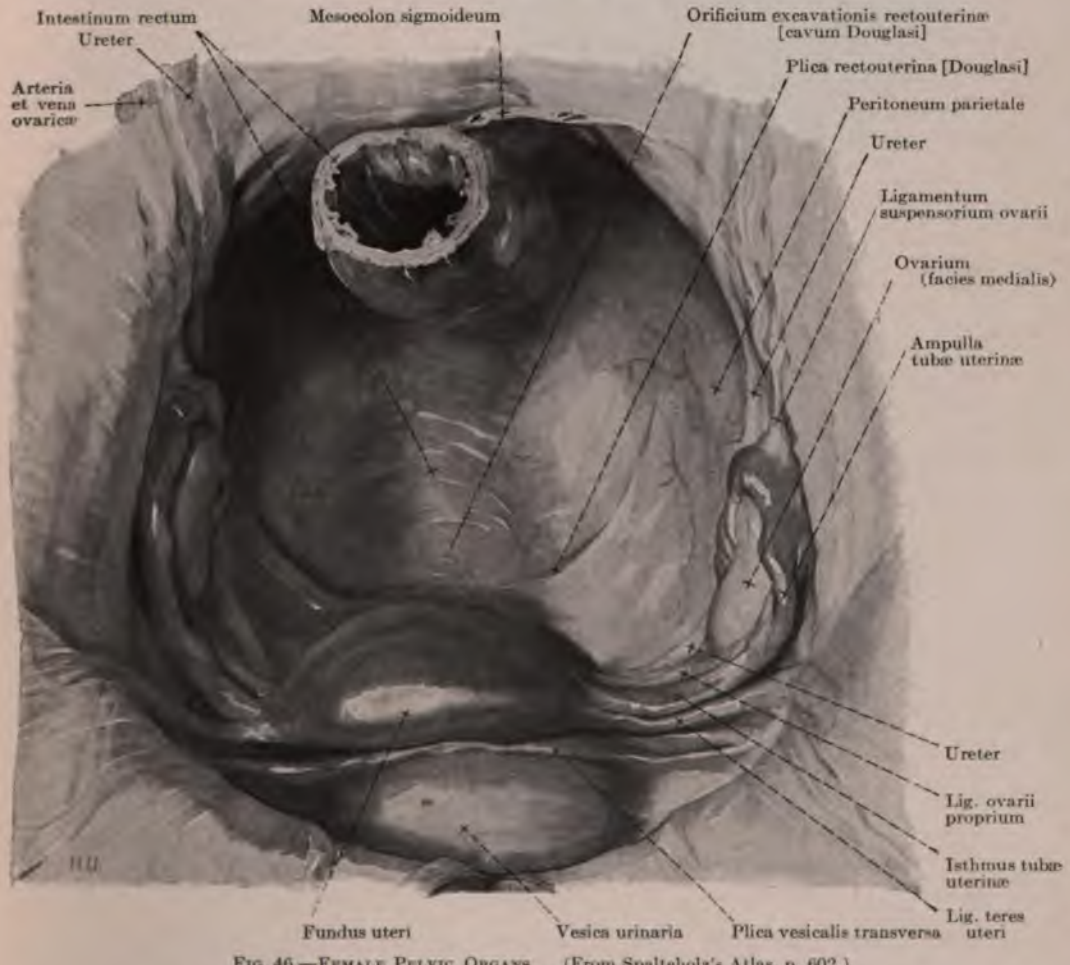


FIG. 46.—FEMALE PELVIC ORGANS. (From Spalteholz's Atlas, p. 602.)

than in palpating the left ovary, it can nevertheless be found without any difficulty, especially if the examiner sits or stands on the left side of the patient. The other hand need be employed only if it is found impossible to make an examination of the right adnexa in this way. In examining the ovaries the points to be noted are: the size, shape, surface, degree of sensitiveness, and mobility. The chief sources of error are scybala, or, on the left side, the empty sigmoid flexure, which are frequently mistaken for the ovaries.

The **Fallopian tubes** are small hollow muscular cords from 10 to 12 cm. in length. They are situated in the upper free margin of the broad ligament and are therefore covered with peritoneum, so that only a small portion of their lower periphery is directed toward the connective tissue of the broad ligament (Fig. 48). From the open, fimbriated extremity the fimbria ovarica passes along the infundibulo-pelvic ligament to the ovary. The Fallopian tube begins at the cornu of the uterus, runs at first horizontally immediately behind the anterior pelvic wall, takes an upward direction just before reaching the ovary, passing over that structure, and dips down with its abdominal extremity into the lateral portion of Douglas's space, where the infundibulum occupies a position near the sacro-iliac articulation. The tube is accompanied by the adjoining portion of the broad ligament, the so-called mesosalpinx, which also passes over the ovary and covers the hilus almost completely (Fig. 46).

Fallopian Tubes.

Fig. 47.—Horizontal Section of the Pelvis through the Middle of the Symphysis and the Third Sacral Vertebra, Showing the Horizontal Extension of the Pelvic Connective Tissue (modified after Freund): In front, the bladder; in the middle, the cervix; behind, Douglas's space and the rectum; on each side of the cervix, the ureters. ⅓.

The tubes can be palpated only when the abdominal walls are unusually yielding. The uterine extremity is a little thicker and is more readily palpated than the abdominal end, which is too soft to be felt. The tubes are found by holding the fingers close together and passing them to and fro in a direction perpendicular to the line of the tubes, when they may be felt as soft cords about the thickness of a knitting-needle. The chief source of error is the ovarian ligament which, however, is shorter and firmer in consistency. Normal tubes are not painful.

Palpation of the Tubes.

The **parametrium,** or pelvic connective tissue, is part of the connective tissue that is found all through the body, with which it is continuous. The main stem of the connective tissue forms a horizontal layer, which is bounded below by the levator ani, and covered above with peritoneum (Fig. 49). As the latter dips down it forms a number of pockets of varying depth. The upper boundary of the pelvic peritoneum is very irregular, and its thickness varies greatly in different places. The parametrium is best developed between the cervix and the pelvic wall, where it is known as the basis

Parametrium.

of the broad ligament or cardinal ligament. It supports most of the vessels and the ureter. This main portion of the pelvic connective tissue is perforated in front by the bladder and urethra, in the middle by the genital canal, and posteriorly by the rectum, so that these structures are enveloped in connective tissue (paracystium, paracolpium, paraproctium). Owing to this arrangement, the connective tissue is least abundant in the median line, while in the interval between the lateral surface of the organs and the pelvic wall are found the two chief masses of connective tissue, which are connected in the middle, particularly in front of and behind the cervix, by bands surrounding the latter (Figs. 47 and 49). This main central portion of the parametrium sends out processes in various directions. Above it gives rise to the connective tissue of the broad ligament, which gradually becomes narrower and extends to the tube (Fig. 48); in front it comes in direct relation with the cavum praeperitoneale Retzii, surrounds the lateral wall of the bladder, and passes upward to the abdominal wall as the retroperitoneal tissue. The retro-cervical connective tissue gives off a branch known as the recto-vaginal septum, which dips down between the posterior wall of the vagina and the rectum and, becoming gradually thinner, extends to a point half way up the posterior vaginal wall. The large masses of connective tissue along the pelvic wall are in direct communication with the connective tissue lying on the iliac bone; posteriorly the peritoneum merges with the retroperitoneal connective tissue and, through the sciatic notch, with the connective tissue underneath the gluteal muscles. In front it escapes from the pelvis underneath Poupart's ligament and passes to the connective tissue of the thigh.

FIG. 48.—SAGITTAL SECTION THROUGH THE PELVIS TO THE LEFT OF THE UTERUS, SHOWING THE BROAD LIGAMENT RISING OUT OF THE HORIZONTAL LAYER OF CONNECTIVE TISSUE (modified after Freund). In front, the bladder; behind it, the ureter; behind that, the vaginal portion within the vault of the vagina, which is seen in oblique section. ⅓.

The connective tissue is everywhere so soft that it offers no resistance to palpation. Wherever there is normal connective tissue the palpating fingers come together without feeling anything.

The **urinary bladder** is interpolated between the vagina and uterus (Figs. 40 and 44). The lower wall of the bladder is intimately connected with the anterior wall of the vagina and adjoining parametrium. The posterior wall of the vagina is connected with the

anterior wall of the cervix from the internal os downward to the insertion of the vaginal vault; when the bladder is distended with urine, the loosely adherent peritoneum is separated from the anterior wall of the uterus, and larger portions of bladder and uterine wall are in contact. Laterally from the cervix the bladder is also connected with the parametrium. The upper wall is covered with peritoneum and the anterior is attached by means of loose connective tissue to the posterior wall of the symphysis and the horizontal ramus of the pubes. When the bladder is empty, the upper wall is hollowed out like a saucer and in contact with the lower wall. As the organ fills, the urine

Urinary Bladder.

FIG. 49.—FRONTAL SECTION THROUGH THE FEMALE PELVIS. (Modified after Waldeyer.) The vagina has been opened, showing the vaginal portion of the cervix; above, the anteflexed uterus with its peritoneal coverings; on each side, the base of the broad ligament traversed by the ureter; the vessels are dissected out on the left side, while on the right they are still covered with peritoneum.

collects first in the lateral portions of the bladder, then the upper wall separates from the lower, until finally, if the distention continues, the shape of the bladder becomes approximately spherical.

When empty the bladder is felt to be soft and flabby; even when it contains a moderate quantity of urine it is still so flabby that it cannot be palpated. There must be from 300 to 400 c.c. in the organ before it has the resistance of a moderately cystic tumor, which is often situated a little to one side of the median line. A greatly distended bladder may simulate a cystic tumor, and when it is filled to bursting it may even give the impression of a solid tumor.

Palpation of Bladder.

The cystoscopic findings in the normal bladder are as follows (Fig. 50):

As the cystoscope is introduced into the bladder, the internal orifice of the urethra, which forms the boundary between the two structures, is distinctly seen. At the anterior boundary, where the transition takes place at a sharp angle, the orifice appears sharply outlined as a bright (translucent) ridge of mucous membrane; behind, where the transition is gradual, the intensely red, velvety urethral mucous membrane gradually merges into the mucous membrane of the bladder; depending on the position of the cystoscope, the transition at this point may also be more or less abrupt. After the prism of the cystoscope has entered the bladder, the wall of the viscus comes into view. The mucous membrane is yellowish-white, often intensely white in color, and the entire periphery of the bladder, as far as the posterior wall, is almost devoid of vessels; only occasionally a slender vein or artery appearing here and there. In the trigonum the injection is more abundant, and vessels are seen extending in fan-like formation from the urethral orifice toward the openings of the ureters and sometimes surrounding them; the entire mucous membrane, owing to the greater vascularity, shows a diffuse blush.

Fig. 50. — Cystoscopic Picture of the Normal Bladder. (Modified after Zangemeister.)

The most important part of the picture is the trigonum, which is bounded by the two ureteral orifices and the inter-ureteric ligament connecting them. Depending on the distance between the ureteral openings and their distance from the urethral orifices, the angle of the trigonum is found to be either an acute or obtuse angle.

The ureteral orifice is distinctly seen as a small opening, shaped like a cleft or occasionally round, and lying near the median line on a slight oval prominence, which gradually merges on each side with the wall of the bladder. The inter-ureteric ligament which connects the two eminences is often merely indicated and sometimes cannot be seen at all. By close observation the urine may be seen spurting out of the ureteral orifice and setting up a vortical movement in the injected fluid; the frequency of the phenomenon will depend on the secretory activity of the kidneys. The two ureters usually work synchronously; as the urine is extruded, the contraction of the ureter not infrequently can be seen, particularly if the eminence surrounding the orifice is well marked.

Aside from the trigonum, the normal bladder-wall presents a uniform picture, except above, at the vertex, where one or two points of interest may be noted. At the highest point of the vertex is a small

air-bubble, formed by the air which enters with the cystoscope; it varies in size and is in close contact with the upper wall of the bladder. This air-bubble is most useful for purposes of orientation. Occasionally one may see slight protrusions of the vesical wall, corresponding to neighboring organs in close contact with the viscus; as, for example, in front, the swelling of the symphysis, and above, the "shadow of the uterus" (Stöckel). Occasionally the peristaltic movements of the coils of intestine can be distinctly seen through the upper wall of the bladder, as well as a displacement of the organ synchronous with the respiratory movements.

Ureter.

The **ureter** passes immediately behind the insertion of the infundibulo-pelvic ligament, over the ilio-psoas muscle, and enters the true pelvis, where it runs behind and below the ovary and enters the broad ligament (Figs. 44, 46, 49); traverses the connective tissue, and approaches the cervix from above to within about 1 cm. at the level of the internal os (Fig. 47); from that point it passes in a direction from above, behind and outside—downward, inward and forward to the anterior vaginal vault, with which it remains in close contact for a distance of 1 to 1.5 cm., and enters the posterior wall of the bladder from behind and above (Fig. 44).

Palpation of the Ureters.

Only that short portion of the ureters which is in contact with the anterior vaginal vault is accessible to palpation. They may be felt for a distance of 1.5 to 2 cm. from about the point where the urethra dips down to enter the bladder, in the lateral portion of the anterior vaginal vault, toward the base of the broad ligament, and give the impression of smooth, easily movable cords which are lost as they pass upward. They form a triangle open posteriorly. Under normal conditions palpation of the ureters is very uncertain; when the tissues are thickened, the ureters can be felt somewhat more easily and over a considerable extent. Palpation can be rendered much easier by introducing an ureteral catheter.

Rectum.

The **rectum** enters the left side of the true pelvis in front of the sacro-iliac articulation and, approaching the median line, courses downward along the anterior excavation of the sacrum. At about the level of the linea arcuata the rectum loses its mesentery, and from that point, covered with parietal peritoneum, is extra-peritoneal down to the floor of Douglas' space; from this point down to the anus it is completely enveloped in pelvic connective tissue (Figs. 40, 44 and 46).

The rectum is situated approximately in the median line in front of the sacrum, and, when it is empty, can be felt as a movable band about as wide as a man's finger; when it contains feces, soft doughy masses may be felt in the lower portion of the canal. When the

finger is introduced into the rectum, it first enters the ampulla; when the gut is empty, the walls are in close contact, and farther up are often difficult to separate. About 6 cm. above the anus a crescentic fold of mucous membrane is felt, chiefly in the anterior and right wall of the rectum and encroaching on the lumen (fold of Kohlrausch) (Fig. 40).

Palpation of the Rectum.

On the left side, at the level of the pelvic inlet and a little above it, is felt the sigmoid flexure, which projects more or less into the pelvis, depending on the length of its mesentery, and occasionally may occupy the median line in front of the uterus. When empty it forms a ribbon-like, very movable band; when it is full, soft masses of feces or hard scybala are sometimes felt and may simulate the ovary or tumors of the adnexa (Fig. 51).

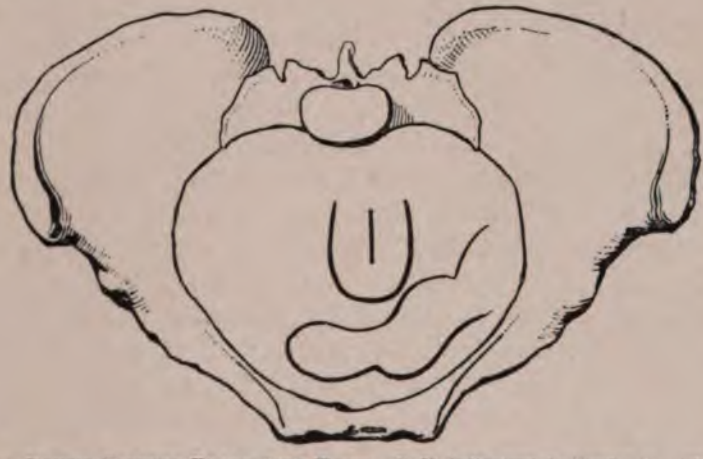


Fig. 51.—Sigmoid Flexure Filled with Feces. P.-F. (palpatory findings). ⅓. (Original.)

For purposes of orientation it is important to be familiar with the **bony parts of the pelvis** that can be palpated through the vagina. We can feel the posterior wall of the symphysis and the horizontal and descending ramus of the pubes. Only the upper portions of the ascending ramus of the ischium are accessible to palpation, while the tuberosity of the ischium and ascending portions can rarely be felt through the superimposed soft parts. With regard to the descending ramus of the ischium, the spine is readily felt and is an important landmark by which we determine the level of the vaginal portion of the cervix. The linea arcuata can be readily palpated if the vaginal walls are not too resistant, particularly under anesthesia; also the upper border of the sciatic notch. The promontory and the upper segments of the sacrum can be reached if the pelvis is not too wide; while the posterior, widely arching portions of the sacrum can rarely be felt from in front.

Bony Parts of the Pelvis.

Occasionally an individual **muscle** can be felt **in the true pelvis,** particularly if it is in contraction. The pyriformis forms a slight prominence on the anterior wall of the upper half of the sacrum. Along the anterior pelvic wall on the obturator foramen the flattened obturator internus can occasionally be felt, and at the level of the pelvic inlet one feels the belly of the iliopsoas muscle, extending from within and above—downward and outward.

Muscles in the True Pelvis.

Lymphatics and Lymph-Glands. The lymphatics of the entire vulva and lower third of the vagina empty into the inguinal glands. The latter also receive a lymphatic vessel which originates at the cornu of the uterus and passes through the inguinal canal in company with the round ligament. The lymphatics of the middle third of the vagina traverse the pelvis singly; those of the upper third, in company with the lymphatics from the vaginal portion of the cervix, unite to form large masses which pass through the base of the broad ligament (Fig. 52) to the hypogastric glands situated near the point where the uterine artery is given off, and to the two or three iliac glands which are found at the point where the hypogastric and iliac arteries separate. These iliac glands also receive a few large trunks from the lower portion of the body of the uterus. The lymphatics of the upper portion of the body and those of the fundus collect at the lateral border of the uterus to form larger trunks, anastomose with the lymphatics of the cervix, and pass along the upper border of the broad ligament in company with the lymphatics of the tube and ovaries to the infundibulo-pelvic ligament, in which they pass upward and then dip down on the anterior surface of the vertebral column to enter the lumbar glands, which surround the aorta at the level of the lower border of the kidney. A few smaller lymphatics from the upper part of the vagina and cervix enter the sacral glands which are situated in front of the sacral foramen. A few smaller lymph-glands are lodged in the tissue of the parametrium.

Lymphatics and Lymph-glands.

The pelvic glands can rarely be palpated unless they are enlarged, when they can be demonstrated under profound anesthesia by inserting two fingers into the rectum toward the linea arcuata and making pressure with the external hand at the corresponding point. The lumbar glands can be palpated only when they are very much enlarged.

Palpation of the Pelvic Glands.

Finally, it is necessary for a complete gynecologic diagnosis for the examiner to be familiar with the **blood-vessels** which supply the internal female sexual organs. They receive their blood from two directions:

Blood-vessels.

The internal spermatic or ovarian artery, which is given off directly from the abdominal aorta, crosses the iliac vessels near,

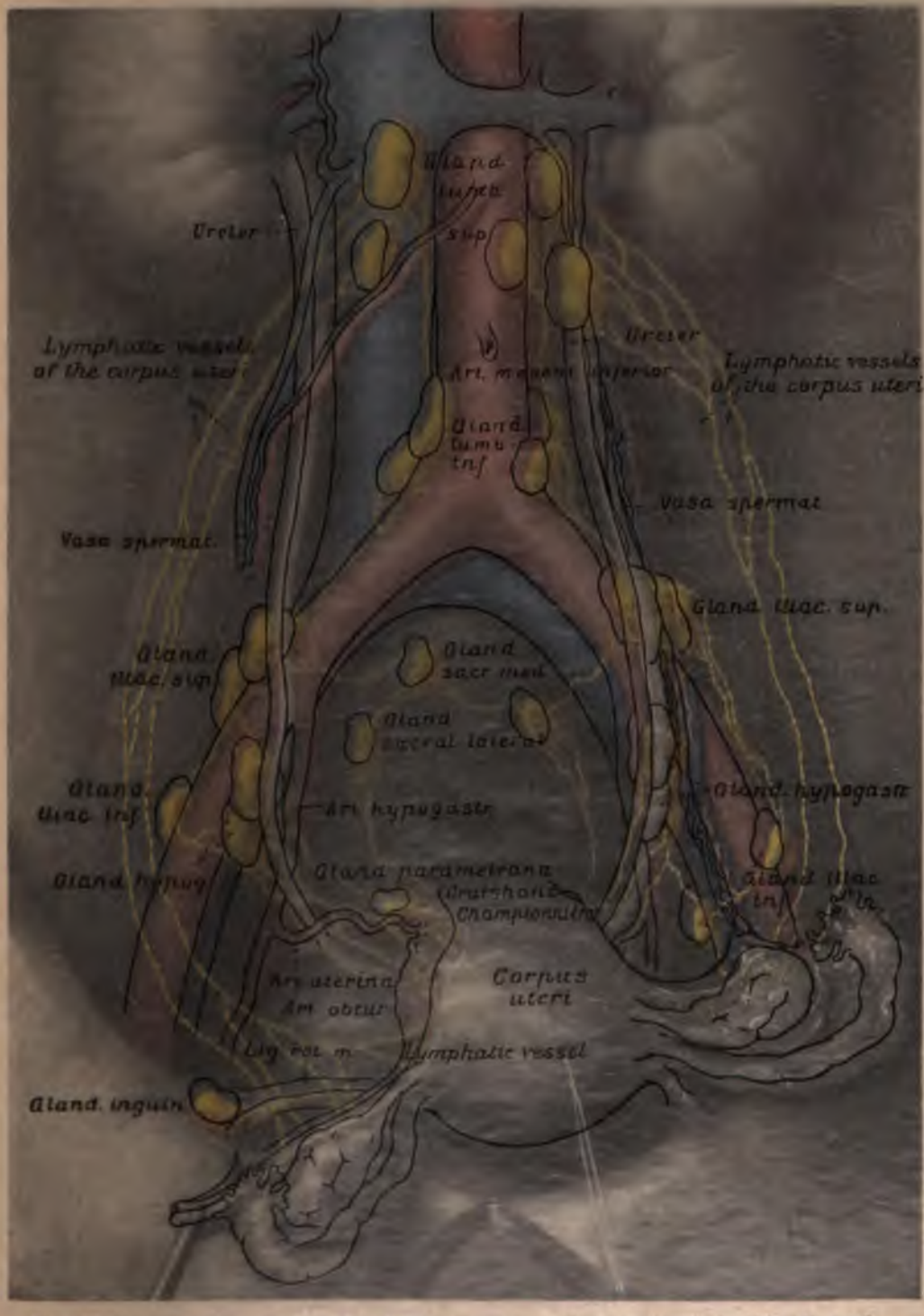


FIG. 52.—LYMPHATIC APPARATUS OF THE FEMALE GENITALIA. (In part schematic.) (After Doderlein and Krönig.)

Occasionally

particularly

protuberance

at the

Lymphatics and Lymph

and

The

upper

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three iliac glands

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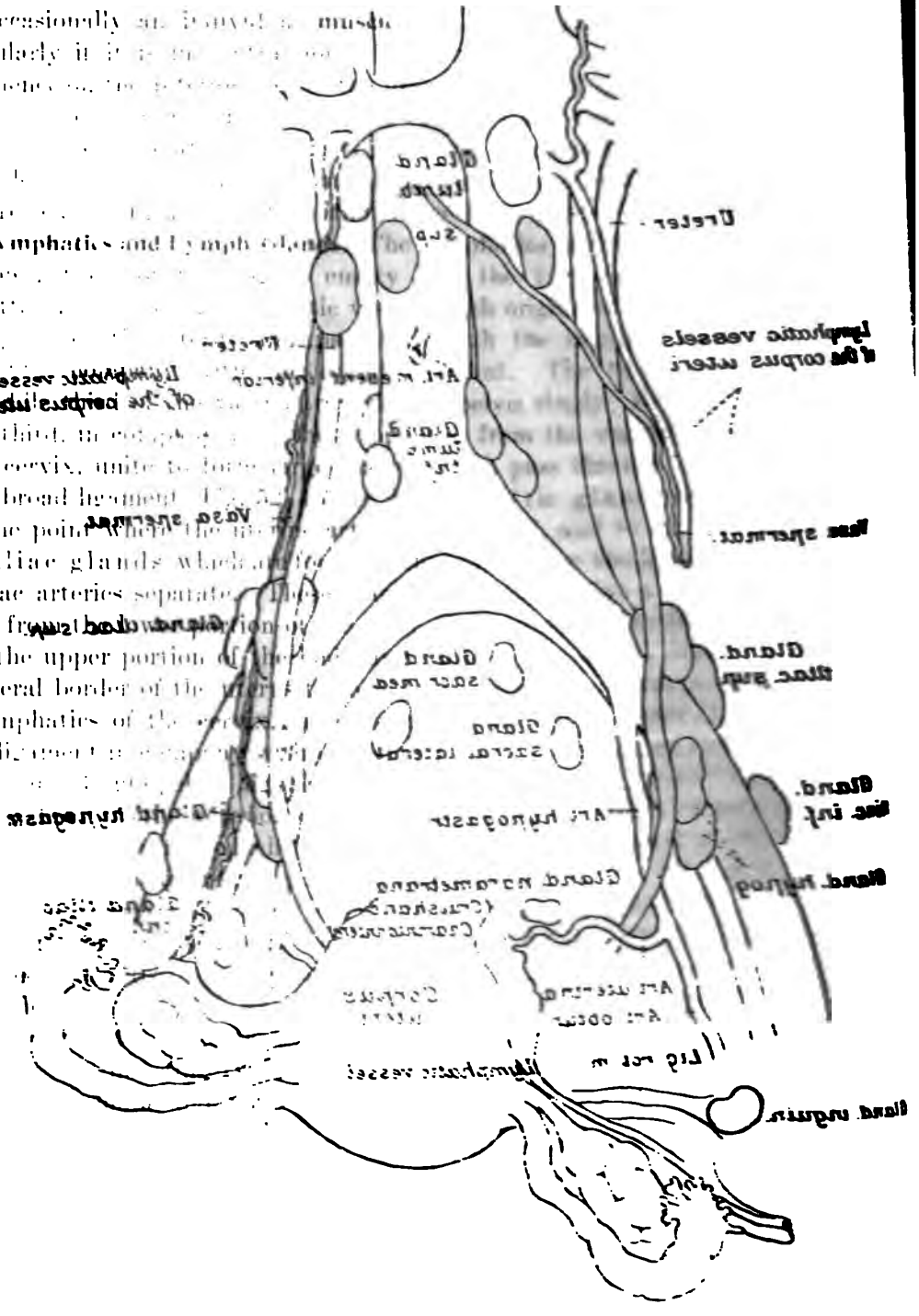

FIG. 52.—LYMPHATIC APPARATUS OF THE FEMALE GENITALIA. (In part schematic.) (After Döderlein and Krönig.)

and in front of the ureter, enters the infundibulo-pelvic ligament opposite the pelvic inlet, follows the upper border of the ovary, which it supplies along with the tube, and anastomoses with the corresponding terminal branch of the uterine artery.

The uterine artery, a branch of the hypogastric, is at first subperitoneal and follows the inner wall of the pelvis for a certain distance; it then leaves the pelvic wall and turns toward the median line, traversing the parametrium to reach the cervix, after giving off

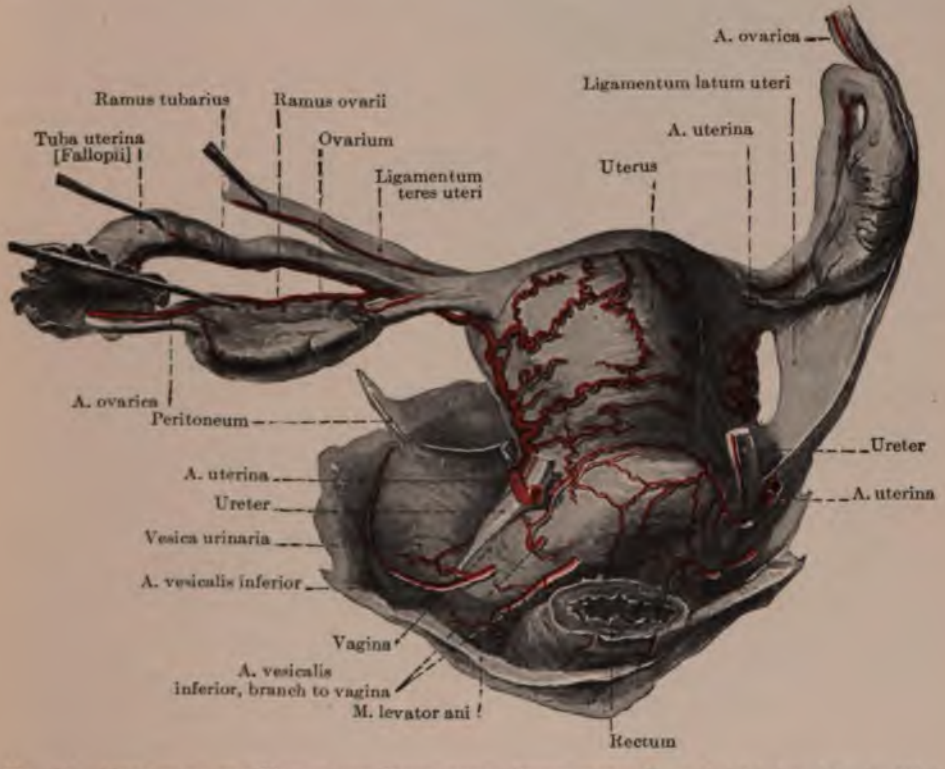

Fig. 53.—Arteries of the Uterus and Surrounding Structures. (From Spaltehola's Atlas, p. 431.)

near the vaginal vault the vaginal artery, which descends along the lateral wall of the vagina. The main branch of the uterine artery turns on itself at the cervix and follows a very tortuous course upward between the two layers of the broad ligament along the lateral margin of the body of the uterus, supplying to both walls of the uterus branches which surround the body and anastomose with the arteries of the opposite side. At the cornu it gives off one branch to the tube, another to the round ligament, and with its terminal branch supplies the ovary, running between the two layers of the broad ligament to meet the terminal branch of the spermatic artery. (Fig. 53.)

In a similar manner the veins carry off the blood of the internal genitalia in two directions. The veins of the ovary and of the lateral portion of the tube unite with broad anastomosing branches from the uterine vein, to form the spermatic vein, with the production of a dense plexus, the pampiniform plexus, which surrounds the spermatic artery and dips down into the vena cava. The veins of the upper portion of the vagina and uterus join together at the lateral aspects of the organ to form the dense utero-vaginal plexus, and also unite to form the uterine veins, which traverse the parametrium, and empty into the hypogastric vein; the two plexuses anastomose freely with one another (Fig. 54).

Palpation of the Blood-vessels.

The arteries can be palpated when the vaginal branches are dilated and pulsate distinctly. In the same way the pulsation of the large trunks along the pelvic wall can be felt through the rectum. The veins in the pelvic wall are perceptible to the sense of touch only when they are thrombosed.

Histology.

In the discussion of the normal histologic composition of the tissues we shall include only those parts of the sexual organs which are important from the standpoint of microscopic diagnosis. These are the vulva, urethra, vagina, vaginal portion, cervix, uterus and its mucous membranes, and Fallopian tubes.

The **vulva** (labium majus, minus, clitoris, mons Veneris), like the skin of the female body, is everywhere covered with stratified squamous epithelium. Cylindrical in the deepest layers, the epithelium

Histologic Composition of the Vulva.

gradually becomes more cuboidal, while nearer the surface the elements are more circular and distinctly dentate (prickle cells); the superficial layer contains flat, horny cells. —The nuclei of the epithelial cells take the stain readily; they are often absent entirely in the horny layers. The stratified squamous epithelium everywhere contains papillæ with blood-vessels and nerves.—The "external surface" of the labium majus is covered with well developed

Labium Majus.

hair and sebaceous glands; the ducts of the latter open around the hair follicles, three or four being grouped around each hair. The orifice of the duct is situated somewhat underneath the epidermal layer. The sebaceous glands are of the acinous variety; they are lined with cuboidal and cylindrical epithelium, which is arranged in several layers at the opening of the duct. The individual elements, which are forced upward and cast off by the growth of younger cells underneath, become enlarged and swollen by taking up fat droplets and gradually break down. In the duct the cuboidal and cylindri-

cal epithelium of the acini is replaced by the stratified epithelium of the epidermis.—The sweat glands, which must be mentioned in addition to the sebaceous glands, are isolated and traverse the epidermal layer in corkscrew fashion. At their entrance into the subcutaneous connective tissue they are slightly dilated in the shape of a funnel and, after pursuing a straight or slightly spiral course through the subcutaneous tissue, they become convoluted in the deeper layers, at

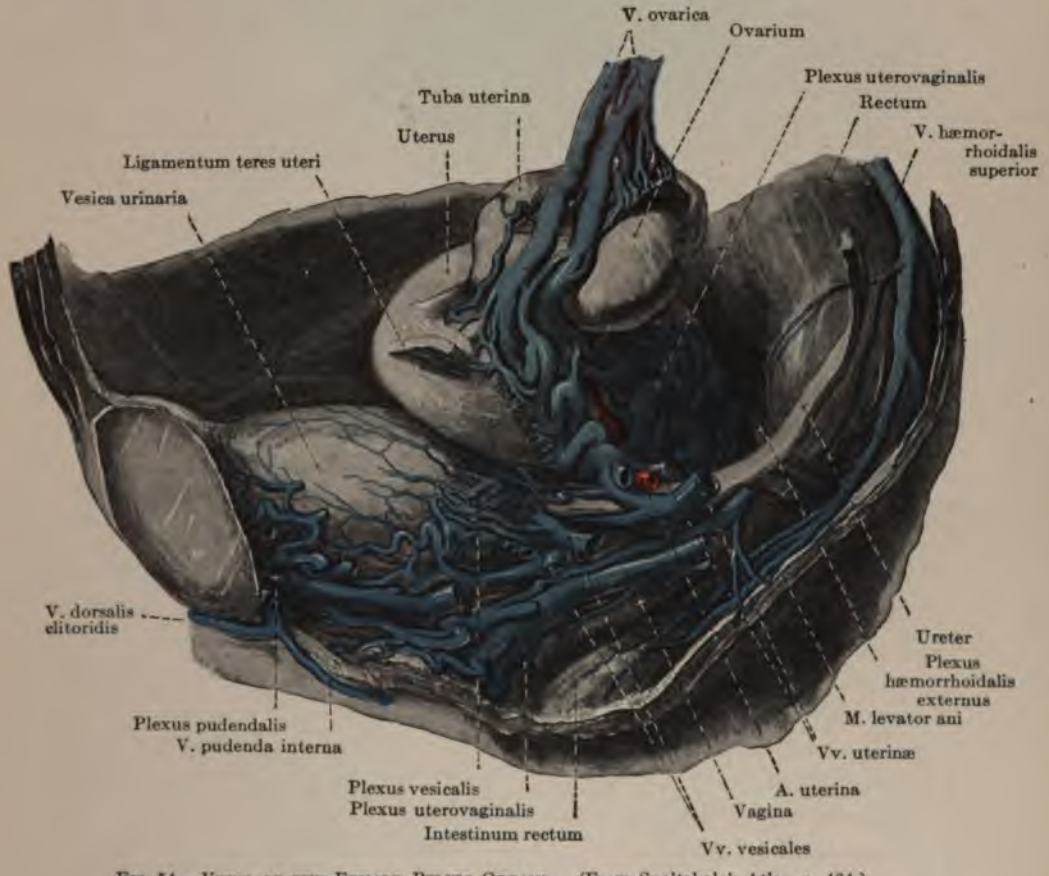

FIG. 54.—VEINS OF THE FEMALE PELVIC ORGANS. (From Spalteholz's Atlas, p. 464.)

the level of the hair papillæ, or sometimes immediately underneath the subcutaneous fatty tissue. The lining of the convoluted extremity of the canaliculi consists of cylindrical epithelium, while the shaft is lined with several layers (from two to three) of epithelial cells.—The loose connective tissue underneath the epidermis, which accommodates the hair follicles, sweat glands, blood and lymph vessels, and nerves, contains the fatty tissue arranged in lobules of varying size (Fig. 55).—The same constituents are constantly found both in childhood and in maturity. In childhood the imperfectly developed hairs (lanugo

hair) appear as appendages of the relatively large sebaceous glands; while in sexually mature individuals the sebaceous glands seem to represent appendages of the hairs (Fig. 56).—As the result of severe disease (febrile conditions) marked changes in the size of the individual parts may occur.—In old age a general atrophy of all the various parts takes place, the epidermis becomes attenuated, the papillæ disappear almost completely, and the boundary line between the papillæ and the subcutaneous tissue, instead of being as before wavy, with a slight bulging toward the deeper layers, becomes smooth and even slightly convex toward the surface. Both in the connective tissue and in the deepest layers of the epidermis pigmentation is seen in old individuals, while it is absent in the tissues of children. The lowest cylindrical epithelial cells of the epidermis (rete Malpighii) often appear brown or blackish in the microscopic picture and exhibit granular pigment.—

FIG. 55.—VULVA OF A NEW-BORN CHILD. The cutis contains sebaceous glands and sweat glands. The former are racemose, the latter tubular in structure:—Lanugo hair. (Original.)

FIG. 56.—VULVA OF A WOMAN. The cutis contains sebaceous glands, sweat glands and hair. (Original.)

For purposes of diagnosis it is important to be familiar with the various pictures, especially those which are oblique or horizontal sections, as well as those produced by sections through the superficial and through the deep layers of the skin. One who has only had the opportunity to familiarize himself with the appearance of the epidermis in a vertical section will find orientation difficult in a flat section and will be in danger of mistaking sections of the epithelial

plugs of the epidermis, which sometimes dip deep down into the tissue, for "solid carcinomatous plugs."—Transverse sections through a shaft of hair, sections of sebaceous glands and also of sweat glands may give rise to error if the examiner is inexperienced.

FIG. 57.—*a*. FRONTAL SECTION OF THE GENITALIA OF A NEW-BORN CHILD. Clitoris, Hymen, Rectum. At the side of the hymen are Bartholin's glands with their ducts. *b*. TERMINAL BRANCH OF BARTHOLIN'S GLANDS: High, translucent cylindrical epithelium with the nuclei situated near the base. (Original.)

Bartholin's glands also deserve attention, as they must be examined in disease and in malignant degeneration. The duct is situated in the lower third of the vulva, a little in front of the hymen; it is quite long, covered with stratified epithelium and often exhibits irreg-

ular dilatations. The lining epithelium of the duct contains numerous vacuoles;—preparations from new-born children contain, in addition to the main duct, one or two short accessory ducts which end blindly (Fig. 57).—The distal portion of the duct breaks up into several branches, so that Bartholin's gland appears to be made up of several lobules and exhibits a racemose structure.—The epithelium of the gland-duct in the region of the gland itself is of the high cylindrical variety, with well-staining nucleus situated near the base. In the terminal branches the epithelium often is low. The epithelial cells are more translucent and, like the epithelium of the cervix, do not stain well (Fig. 58).—The clitoris is covered with stratified squamous epithelium and does not contain any glandular structures. The tissue contains well-developed vessels, especially those of the corpora cavernosa.—The inner aspects of the labia majora are devoid of hair; here we find only sebaceous and sweat glands, the latter disappearing at the junction with the labia minora.—The labia minora are covered with stratified squamous epithelium and contain chiefly sebaceous glands (epithelial derivatives) which are flat (umbrella or fan-shaped), and spread out underneath, and parallel with the squamous epithelium. In old age the glands undergo considerable atrophy. The beautiful, branching, racemose gland lobules covered with epithelium are often replaced by hollow epithelial depressions which end abruptly, or may here and there be provided with a knob-like prominence at their extremities, the remains of the gland-body (senile condition).—In new-born children, and in most girls up to the age of ten or twelve years, the labia minora contain no sebaceous glands. Occasionally the beginning of sebaceous gland formation may be recognized as early as the sixth or seventh year; rarely at a still earlier date. The great paucity of sebaceous glands before the establishment of menstruation, compared to their abundance later on in the sexually mature woman, throws a special light on the development of these structures.—The hymen, like the vagina and lesser labia, is covered with stratified squamous epithelium which on the inner vaginal as well as the outer vulvar side is almost of equal height; well developed papillæ can be seen in the epithe-

Bartholin's Glands.

FIG. 58.—TERMINAL BRANCHING OF BARTHOLIN'S GLANDS. The stratified cylindrical epithelium of the excretory duct, containing vacuoles, is gradually replaced by high cylindrical epithelium (57, *b*). (Original.)

New-born.

Hymen.

lium.—The squamous epithelium rests on a thin groundwork of connective tissue.—In very rare preparations the excretory duct of Gartner's canal can be demonstrated on the hymen. (R. Meyer.)—

An accurate acquaintance with the urethra is also important to the diagnostician. Pieces of tissue are often excised from a hypertrophied urethra, for purposes of examination, and a diagnosis of malignancy is not infrequently made in such cases. In the female urethra the muscular portion, which exhibits an inner longitudinal and outer circular layer, must be distinguished from the mucous membrane; the mucous membrane in the sexually mature individual shows stratified squamous epithelium. In the higher portions near the bladder a single layer of high cylindrical epithelium is described, while other authors speak of the

Histologic Composition of the Urethra.

Fig. 59.—Urethral Mucous Membrane; Peripheral Extremity. Stratified cylindrical epithelium; transverse section of the depression which in part already appears to be solid. (Original.)

epithelium in this layer as transitional epithelium or modified stratified cylindrical epithelium. The mucous membrane contains few if any glands, except at the urethral orifice, where a small group of glands is found.—These glands exhibit stratified epithelium, and on the surface an investment of cylindrical epithelium (stratified cylindrical epithelium) (Fig. 59). The epithelial proliferation of the glands, which often look like crypts, is not infrequently quite well marked. Cross-sections and oblique sections are very apt to simulate solid carcinomatous plugs, but the cylindrical epithelium at the surface catches the eye and is an important factor in the diagnosis. Special care is required in the interpretation of the pictures produced by papillary proliferation (caruncle, condylomatous excrescences).—

Of the urethral glands situated in or at the entrance of the urethra Skene's glands, which are present on each side, deserve attention. In addition to the crypt-like depressions surrounding the urethra, which are often multiple and may simulate gland-ducts, Skene's glands are sometimes unusually well developed in the

Skene's Glands.

lower third of the entrance to the urethra.—The urethral mucous membrane contains large vessels, especially veins.—The epithelial lining of the urethra in children is exactly as above described, except that the dimensions are correspondingly diminished.—The bladder is covered with stratified squamous epithelium (Fig. 60).

Vesical Epithelium.

The **vagina** presents, for microscopic examination, chiefly two parts: the stratified squamous epithelium with the subjacent connective tissue and the deeper layers of muscle.—The squamous epithelium resembles that of the external skin and of the vulva, except that it does not contain hair, sweat glands or sebaceous glands. The papillæ of the epithelial layer are well developed, and share actively in the morbid process in cases of inflammatory disease.—The superficial layers of squamous epithelium do not contain horny elements; the

Histologic Composition of the Vagina.

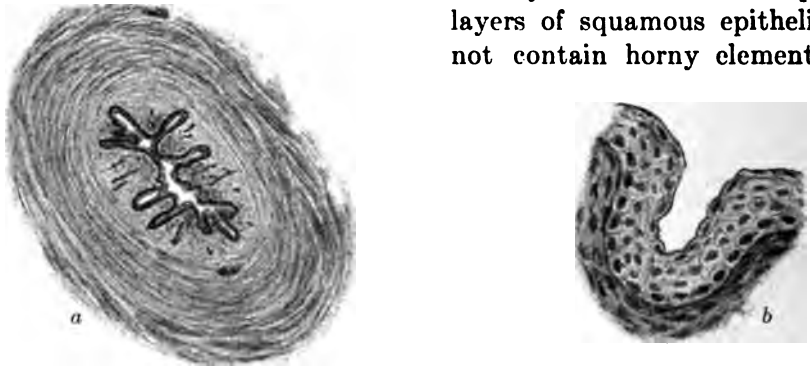

FIG. 60.—*a*. BLADDER OF A NEW-BORN CHILD AT THE LEVEL OF THE VAGINAL PORTION. *b*. STRATIFIED SQUAMOUS EPITHELIUM. (Original.)

vagina is usually moist and frequently presents the familiar secretion known as leucorrhea (fluor albus). The latter contains normally nothing but squamous epithelium, a few lymph cells, and mucus corpuscles. Occasionally the trichomonas is present as a parasite, as well as a few bacteria, thrush fungi (oidium albicans), and masses of other fungi.—The superficial layer of epithelium in the vagina undergoes cornification only in cases of prolapse. The prolapsed portion becomes dry, leathery, scales off, and may, when exposed to mechanical injury and as a result of the lack of cleanliness, become ulcerated. The layer of squamous epithelium invests the entire vagina as far as the external orifice, following the many projections and folds of the mucous membrane.

Epithelium of the Vagina.

The vagina occasionally contains the vaginal glands which have been accurately described by v. Preuschen. They are lined with tall cylindrical, or even ciliated epithelium and exhibit the character of cervical epithelium (see below).—

The normal epithelium of the vagina is altered in hematocolpos: instead of the robust, stratified squamous epithelium there is a thin layer of epithelial cells without the large superficial squamous elements which are normally present; instead we find only a few rows of small epithelial cells with easily recognizable nuclei. Condition in Hematocolpos. —In rare cases the vaginal wall appears pinkish and covered with a single layer of beautifully ciliated, cylindrical epithelium. This layer of epithelium sends down small "gland-like" depressions into the subjacent tissue.—In these preparations, derived from the lowest portion of the hematocolpos which protrudes into the vulva, the epithelium is tall, translucent, does not stain, and the nucleus is situated near the base. It shows a "cervical character." By the subsequent conversion into epidermis (epidermidalization) glandular portions may be constricted off and remain isolated in the depths of the tissue.—The vaginal wall occasionally contains small epithelial (glandular) formations, the remains of the Wolffian (Gartner's) duct. These, like v. Preuschen's glands, may form the beginning of pathologic formations, such as cysts and benign or malignant adenomata. In making the diagnosis the character of the epithelium must be studied.—The cysts and glandular structures of the vagina, which are occasionally covered with a single layer of cylindrical epithelium, may be explained by the fact that during the earlier stages of development the entire genital tract (vagina, cervix, body and tubes) is covered only with a single layer of cylindrical epithelium.—It is probable that these structures (except those which have their origin in Gartner's canal, and which can be recognized by their situation in the anterior wall) belong, together with the formations of so-called congenital erosion (see below), to the same stage of development.—

Fig. 61.—*a*. Transverse Section through the Vagina of a Girl Fourteen Years Old. *b*. Transverse Section of the Vagina in a New-born Child. *c*. Vagina, Mucous Membrane, Stratified Squamous Epithelium, and Muscularis. (Original.)

Gartner's Duct in the Vagina.

The thickness of the epithelial lining of the vagina varies according to age and the individual. In the child and new-born infant, in comparison with the size of the parts, the epithelium is very well developed

and contains large papillæ (Fig. 61, *c*). The boundary line between the rete Malphighii and the underlying connective tissue is slightly wavy, the epithelium projecting into the connective tissue layer; while in old age the epithelium becomes thin and smooth (senile atrophy), in contrast to the rougher surface with numerous projections seen in the juvenile vagina. The epithelial layer no longer encroaches on the connective tissue; on the contrary, the boundary line is rather a little concave.—A transverse section through the vagina of the child and new-born infant is more nearly like a square in outline, as compared to the cross-section of the sexually mature individual, which is more oblong (Fig. 61, *a* and *b*).—

The second constituent, the muscularis of the vagina, is made up of several layers arranged without definite

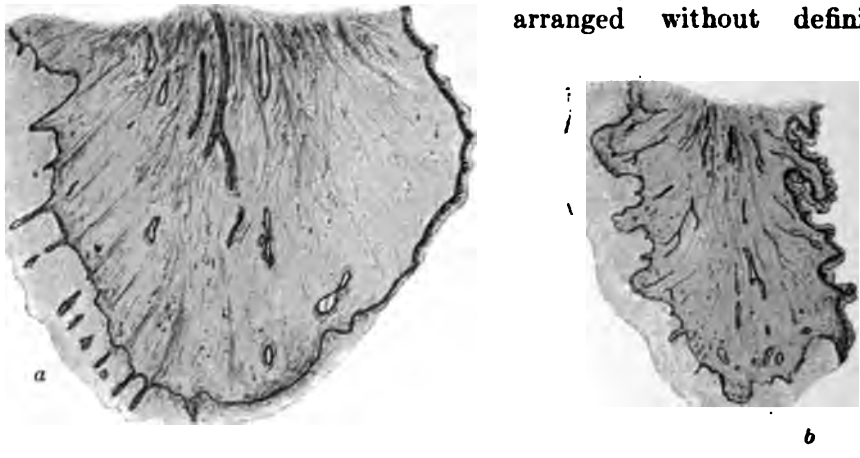

FIG. 62.—*a*. VAGINAL PORTION OF A VIRGIN. *b*. VAGINAL PORTION OF A NEW-BORN CHILD. (Original.)

order. An outer, more longitudinal, and an inner, circular layer are distinguished.—The bands of muscle consist of smooth muscle fibres which interlace closely with one another; between the muscularis and the epithelial layer is a thin layer of rather dense connective tissue, while a looser connective tissue connects the vagina with the surrounding structures. The lower portion of the urethra, however, is intimately attached to the vagina.

Muscularis of the Vagina.

In the uterus three parts must be sharply distinguished: the vaginal portion, the cervix, and the body. Each segment is sharply separated from the next. Once the parts have become differentiated in fetal life, the three sections remain absolutely distinct during the entire life of a woman, both during pregnancy and inflammatory and malignant alterations. Each individual portion has its own special epithelial covering, and in part also its own tissue; even the changes (especially the malig-

Composition of the Uterus.

nant changes) which occur show, in the main, a more or less specific character in the individual segments.—The cervical canal begins at the external os and extends to the internal os; this in turn forms the beginning of the uterine cavity (cavum corporis uteri), which in sagittal section has the appearance of a canal.—

The **vaginal portion** in a sexually mature individual is covered with stratified squamous epithelium, which is the continuation of that in the vagina. In the deepest layers the cells represent short cylinders, and near the surface are converted into squamous elements.—The epithelium contains numerous slender papillæ which, as the result of abnormally increased vascularity from irritation or inflammation, soon alter their shape and size.—The epithelial covering is intimately attached to the tissues of the vaginal portion; there is no mucous-membrane tissue (subcutaneous connective tissue) between the epithelium and the tissue of the vaginal portion (Fig. 62).—Proliferations of the epithelium grow directly into the tissue.—The stroma of the vaginal portion consists of firm connective tissue made up of robust fibres; elastic fibres have also been described.—The vessels pass from below in a straight course like columns to the superficial layers, where they break up into branches, and return as veins.—The central portion of the stroma contains a great deal of muscular tissue derived from the cervix or from the body, usually in company with vessels. A few muscle bundles often accompany the vessels to the cervix.—The stratified squamous epithelium in the vaginal portion in many cases (particularly in virgins) ends at the external os. The whitish, firm epithelium ceases abruptly and is replaced by the more delicate cylindrical elements. The whitish coloring of the squamous epithelium contrasts with the pinkish color (immediately succeeding) of the cervical mucous membrane, which is covered with cylindrical epithelium. Exceptionally, under normal conditions, the stratified squamous epithelium may extend a short distance into the cervical canal; under abnormal conditions, after labor tears, the epithelium may undergo a great many changes (see under ectropion, epidermidalization). —The vaginal portion of the new-born infant differs from the somewhat flattened, smooth vaginal portion of the sexually mature virgin by its slightly conical shape. The thickness of the squamous epithelium varies in different individuals. The papillæ are well developed and the vaginal folds or projections (vaginal type) can be seen not infrequently even with the naked eye, and quite often in the microscopic picture. Sometimes the epithelium covering the vaginal portion is exceedingly thin and made up of only a few layers; as the external os is approached, it becomes thinner by

(a) Portio Vaginalis.

Stroma of Portio Vaginalis.

Epithelium of Portio Vaginalis.

Portio Vaginalis of the New-born.

"sudden leaps." (Fig. 63, *a*.) From the vaginal wall downward toward the portio vaginalis the epithelium diminishes in thickness; indeed cylindrical epithelium of a slightly papillary character may even be present on the outer side of the vaginal portion before the external os is reached (so-called congenital erosion, see Fig. 63, *a* and *b*).—

Congenital Erosion.

Strands of this cylindrical epithelium may extend into the vaginal vault.—Even if the stratified squamous epithelium has not yet reached the external os, this makes no change in the shape of the vaginal portion as compared with the cervix and its characteristic cervical character.—The squamous epithelium encroaches on the cervical canal much more frequently in children than in adults.—The cervical canal in the new-born is often so greatly dilated by mucus at the external os that the tip of the little finger can be inserted. New-born infants rarely exhibit a contracted external os, which is not infrequently observed in adults. We

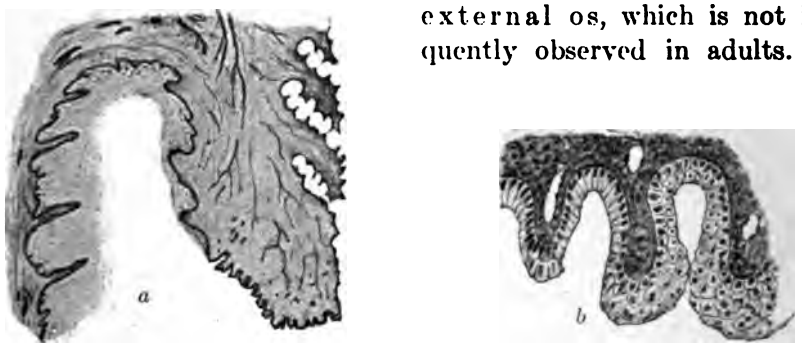

FIG. 63.—*a*. VAGINAL PORTION OF A NEW-BORN CHILD WITH CONGENITAL EROSION. *b*. CYLINDRICAL EPITHELIUM gradually becoming converted into stratified squamous epithelium. (Original.)

cannot speak of a congenitally narrowed external os.—The differences in the epithelium covering the vaginal portion of the new-born infant are explained by the development of that structure. The cylindrical epithelium, which originally covers the vagina, as it progresses from the outside, and the lumen of the vagina is increased, becomes stratified; while the epithelium at the introitus and lower portion is already quite robust, the upper portion of the tube may contain only a narrow zone of squamous epithelium; or the epithelium may even be of the cylindrical variety (see above, congenital erosion).

The surface of the cervix, which begins at the external os, is covered with tall and narrow cylindrical epithelium—short along the top of the ridges, and taller at the bottom of the depressions.—

(b) Cervix.

The epithelial cells are not sharply differentiated from one another.—The boundary line is delicate and finely dotted. The epithelium is often so translucent that it is at first overlooked by the inexperienced, especially under a low power.—The cell-

body does not stain at all (especially when alum-carmine is used), and the outline of the cells very faintly. The nuclei alone stain intensely and usually have the shape of a long oval; when the cells are tall, they are correspondingly narrow, and spherical in the shorter elements; they are finely granular and basally situated close to the lower boundary of the cell.

The character of the cervical epithelium varies at different ages; while in the sexually mature organ the nuclei are almost always basally situated, in children and in new-born infants they are quite often situated higher up in the lower third, or in some places even higher.—Owing to the many ridge-like projections or folds (plicæ palmatæ), which in cross-sections look like papillae, the surface of the cervix is unequal, with shallow depressions; the surface appears wavy.

In addition to these elevations, which simulate papillae (cross-sections of the ridge-like or fold-like processes), true papillary proliferation also occurs, especially when the tissue is irritated, as in inflammatory processes.—The epithelial cells, which on the surface are crowded closely together and are uniform in size, and consequently are often very narrow and high, exhibit a very graceful formation in the papillary projections (Fig. 65): so-called palisade or fan-like formation. When the projections are close together, a very pretty picture is produced by these serried ranks of epithelial cells, which seem actually to interlace, and thus produce the characteristic palisade, bundle, or fan-like formation.—During sexual maturity the epithelial cells are ciliated, although not so regularly as in the case of the uterine epithelium. The ciliated epithelium can be demonstrated only in fresh preparations.—The epithelium covering the surface of the cervix follows the various depressions of the mucous membrane (cervical glands). The latter exhibit various forms, such as large crypts; glands suggesting the racemose type, owing to the various ridges and projections, transverse or flat sections exhibit a peculiar and very graceful formation in the microscopic preparation (Fig. 65, *a*); portions of epithelium apparently project into the lumen and interlace with one another. This arrangement of the epithelium corresponds to the fold-like projections which subdivide and spread out in various directions.—In the second place, we distinguish flask-like depressions, narrow at the entrance like a flask, from which they take their name, and with a slight dilatation below. Under

FIG. 64.—*a*. EPITHELIUM OF THE UTERINE MUCOUS MEMBRANE WITH CILIATED CELLS AND CENTRALLY SITUATED, TINGIBLE NUCLEUS. *b*. EPITHELIUM OF THE CERVIX WITH BASAL NUCLEI. The cells do not stain. (Original.)

Cervical Crypts.

Flask-shaped Cervical Glands.

normal conditions the epithelium covering their surface is smooth and exhibits no elevations.—Third, we have, in addition to the crypts and flask-shaped depressions, the tubular glands which subdivide repeatedly, then undergo further branching, and thus produce a picture which has been compared to the antlers of a stag. These tubular, branching formations in the normal state, and sometimes also when hypertrophied, are narrow (Fig. 66); the glandular elements are almost in contact with those on the opposite side, leaving only a narrow lumen.—The first two formations are found more commonly in the cervix of the infantile uterus; the third, in that of the sexually mature organ.—In the latter the cylindrical epithelium usually begins abruptly at the external os, particularly if the opening is narrow. In new-born infants a portion of the cervix may also be covered with stratified squamous epithelium, as already mentioned above, and the cylindrical epithelium may begin a little higher up. The boundary line between the two kinds of epithelium can be distinctly recognized with the unaided eye by the opaque, whitish color of the stratified squamous epithelium, as compared with the delicate pink of the mucous membrane that is covered with cylindrical epithelium.—In adults the cervix, *i.e.*, the part beyond the external os, may be covered with stratified squamous epithelium in dilatation of the cervix after parturition, in ectropion of the mucous membrane following pathologic processes, and later transformation of the cylindrical epithelium into stratified squamous epithelium (epidermidalization).—The stratified squamous epithelium may cease abruptly, and the cylindrical epithelium begin without any transitional zone; indeed the stratified squamous epithelium quite often appears to be pushed under

Tubular Glands (Antler-formation).

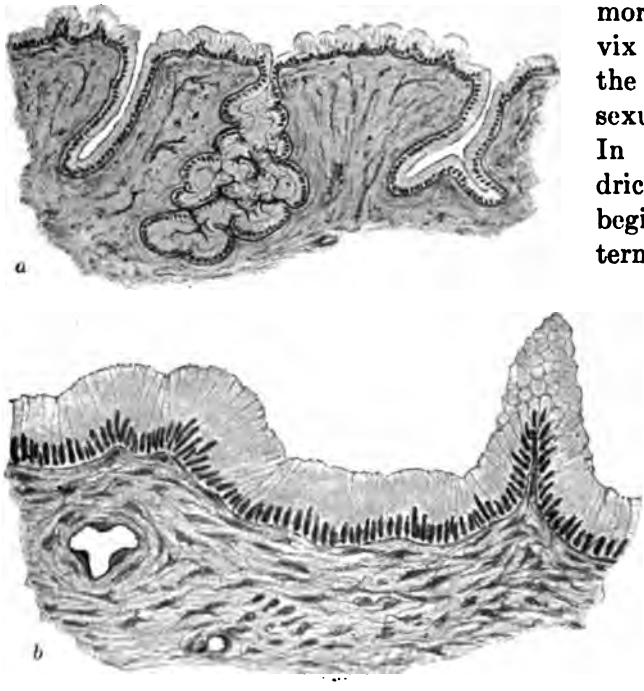

FIG. 65.—*a*. CERVICAL MUCOUS MEMBRANE: Tubular and racemose glands. *b*. CERVICAL EPITHELIUM WITH BASAL NUCLEI. The cell-bodies do not stain. (Original.)

the cylindrical epithelium so that the latter covers the former for a short distance.—In epidermidalization the transition from cylindrical to stratified squamous epithelium is often quite gradual; two or three or more epithelial elements gradually change their shape and pile up on one another.

The cervical mucous membrane, particularly in the new-born infant, often contains a profusion of "goblet-cells" which are very conspicuous by their shape in the microscopic section (appearing like spherical gaps or vacuoles). —These so-called goblet-cells are not intended for the production of the cervical mucus, but rather owe their existence to a degeneration or destruction of the luxuriating epithelial cells. In some uteri the goblet-cells are almost entirely wanting, while in others they are found in large numbers.—

So-called Cervical Goblet-cells.

Fig. 66.—Cervical Gland (antler-formation). (Original.)

The **uterine mucous membrane** (mucosa corporis uteri), both macroscopically and microscopically, in the sexually mature as well as in the infant, has a smooth surface compared to that of the mucous membrane of the cervix. In the sexually mature woman it is from 1 to 2 mm. in thickness and, macroscopically as well as microscopically, is sharply differentiated from the muscularis. The mucous membrane is intimately connected to the muscle and is immovable.—Even in the microscopic picture the cytogenous tissue of the uterine mucous membrane, with its glands, is sharply differentiated from the muscularis by a practically straight or slightly wavy boundary line.—The conditions are the same in the infantile uterus, although they are not quite so conspicuous.—Under morbid irritation the thickness of the mucous membrane may increase tenfold, and the mucous membrane with its glands may dip deep down into the muscular layer (see below).—

The uterine mucous membrane consists of (1) surface epithelium and epithelial depressions (uterine glands); and (2) the stroma, which accommodates both blood- and lymph-vessels. The surface epithelium is cylindrical and both shorter and broader in comparison with the tall cylindrical epithelium of the cervix; it is also somewhat shorter at the surface than in the deeper portions of the mucous membrane. While the cells are less sharply defined than those of the cervical epithelium,

Corporeal Epithelium in the New-born.

the outlines of the individual elements are nevertheless distinctly visible.—The cell-body is finely granular and contains an approximately oval, granular nucleus.—The latter is situated centrally. Both nucleus and cell-body are readily stained.—

The position of the nucleus and the staining properties are characteristic and serve to distinguish uterine from cervical epithelium.—The cylindrical epithelium of the uterine mucous membrane is approximately oblong, becoming more cuboidal, however, as the surface is approached. In transverse or flat sections the cells appear hexagonal, while in longitudinal sections the cylindrical or cuboidal shape is more conspicuous. Flat sections exhibit beautiful hexagons arranged in the form of a mosaic.—Oblique sections show transitional pictures between the hexagonal and cylindrical forms. The epithelium is built up somewhat like the cells in a beehive. The surface epithelium of the uterine mucous membrane in the sexually mature organ differs somewhat from that of the infantile organ. In the former the cells are covered with cilia which, according to M. Hofmeier, have an outward (distal, peripheral) movement. The movements of the ciliated epithelium, which may be compared to the waving of a corn-field, are extremely active and can be seen only in recent specimens. Rarely, the ciliary capping may be demonstrated in hardened specimens.—In certain forms of hyperplastic endometritis the ciliated border appears to be more robust and more resistant (and may be recognized in alcoholic preparations).—

Ciliated Border.

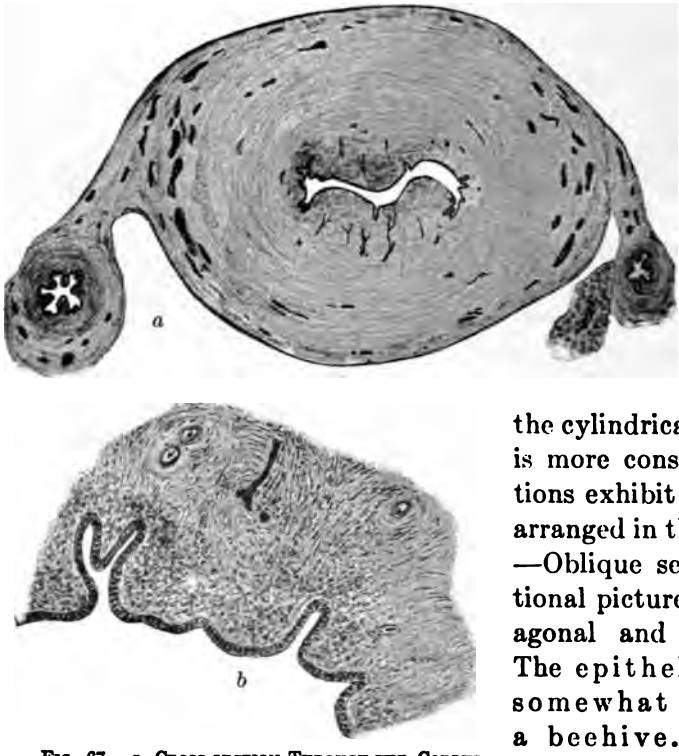

FIG. 67.—*a*. CROSS-SECTION THROUGH THE CORPUS UTERI OF A NEW-BORN INFANT. Uterine mucous membrane with the beginnings of uterine glands. The lateral portions of the section include the tubes and the ovaries. *b*. Cylindrical, finely granular, deeply staining epithelium covering the surface of the body of the uterus. (Original.)

In the climacteric the cilia are lost, although they often survive the cessation of menstruation by a considerable time. The ciliary movements in some cases do not cease until old age begins.—In the climacteric, or occasionally sometime after the cessation of the menses, the cylindrical epithelium of the surface of the uterus (sometimes also that covering the epithelial depressions in the mucous membrane) becomes shorter, loses its tingibility, and is transformed into cuboidal elements like squamous epithelium.—The proliferating power of the uterine epithelium is sometimes incredibly great, even during the first years after the menopause.—A sharp distinction must be made between the climacteric and old age in their relation to the life-history of the uterine mucous membrane.—

Changes—the Climacteric.

The cylindrical epithelium of the uterine surface dips down into the mucous membrane, forming glandular structures—the uterine glands.—In embryonal life the surface of the uterus (like that of the cervix and, in the beginning, also that of the vagina) is covered with a single layer of cylindrical cells.—Long after the vaginal portion has become differentiated from the other segments, apparently by a slight kinking of the lumen and of the covering of cylindrical epithelium, and long after cervical glands have developed in large numbers, a few shallow, insignificant depressions appear in the body of the uterus.—The uterus of the newborn infant shows two kinds of depressions: First, small tubular depressions resembling small uterine glands of the sexually mature individual, except that they are shorter and occupy barely a third, or rarely one-half of the mucous membrane; and second, short racemose invaginations, with two or even three acini (lobules), apparently opening at a single point through a single excretory duct. The epithelium covering the floor of these depressions is occasionally characteristic. While the surface and upper portion of the glandular structure exhibits a typical uterine (corporeal) character, the epithelium at the bottom of the depressions is translucent, does not stain well, and the nuclei are basally situated, producing the picture of the cervical type (Fig. 68).—During pregnancy the uterus of the sexually mature individual also occasionally exhibits this peculiar

Fig. 68.—Uterine Glands of New-born Infant: Showing the epithelium with centrally situated nuclei staining at the surface, and at the floor of the depression assuming the cervical character. (Original.)

Uterine Glands.

Uterine Glands in the New-born.

condition of the epithelium—distinctly corporeal at the surface and cervical at the bottom.—

As sexual maturity is reached, the picture of the uterine mucous membrane rapidly undergoes a change. The mucous membrane increases in thickness; but the principal change lies in the appearance of regular, serried ranks of tubular glands (uterine glands), which extend from the surface to the muscularis. The glands are usually parallel to one another, whether their course be straight or slightly tortuous (Fig. 69). Near the entrance they are apt to be narrow so that the opposed cells are almost in contact; as they descend, the lumen becomes somewhat wider and the fundus of the glands is slightly spherical, or sometimes turned on itself, running parallel with the muscular layer for a short distance, or rarely dipping down slightly into the interstices of the muscular tissue. While the direction of the glands is in the main practically perpendicular to the surface, the arrangement at the cornua and at the cervicofundal flexure is slightly radiating, to compensate for the curve of the gland.—In addition to glands exhibiting a straight or slightly tortuous course, corresponding to lateral protrusions and indentations, cork-screw varieties (pendulum, circular, and screw-like forms) are also observed.—The glands usually have a solitary duct, although occasionally some may be provided with two; sometimes the duct, which is usually single, undergoes division so that we have two glands corresponding to a single excretory duct.—In cross-section (Fig. 70) the uterine glands appear spherical, oval, of uniform width, and separated by equal intervals from one another, the distance being normally equal to from 2 to 2⅓ transverse diameters of the glands. In cross-sections of the glands the cells appear arranged in circles, those at the base, in accordance with the circular arrangement, being somewhat broader than those at the upper extremity. The lumen of the gland is equal in width to about one-half to one cell-length, and of the same height.—Each gland has its vitelline

Uterine Glands in Longitudinal Section.

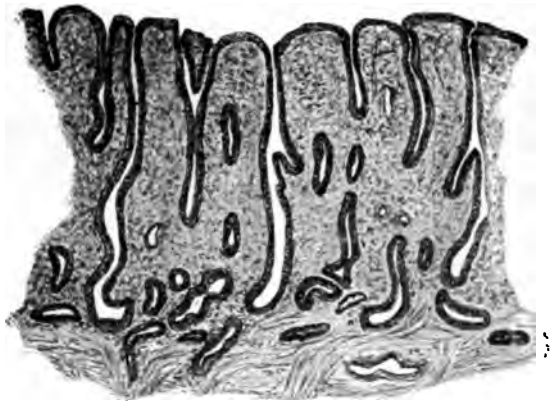

FIG. 69.—NORMAL UTERINE MUCOUS MEMBRANE: The uterine glands are slightly reflected at the edge of the muscular layer. The uterine glands also undergo division or they are provided with branching ducts. (Original.)

Uterine Mucous Membrane of the Sexually Mature Woman.

Uterine Glands in Cross-section.

membrana propria, which is difficult to demonstrate; if the cell is carefully macerated in watery serum the entire membrane may sometimes be brought out.—The glands themselves are, in addition, surrounded by a network of spindle-shaped connective-tissue elements with somewhat oval nuclei; these are in close contact with the membrana propria, and with the latter form the envelope of the glands; outside of this is found the stroma with its round cells.—

Membrana Propria.

After the climacteric—at the beginning of old age—the uterine mucous membrane, owing to atrophy of all its constituents (epithelium, as well as connective tissue) undergoes considerable changes. It becomes much thinner, the boundary line between it and the muscular layer is more irregular and, instead of representing a straight line, convex toward the surface (toward the lumen of the uterus). —The surface epithelium is shorter, cuboidal, less easily stained, and pale (see above). The glands are few in number, their course is quite irregular and parallel to the surface; here and there are seen small gaps in the tissue containing epithelial cells in process of decomposition.—The glands appear crumpled, "atrophic."

Fig. 70.—Uterine Mucous Membrane: Showing the cylindrical epithelium with central nucleus; opening of a uterine gland; cross-section of a uterine gland. (Original.)

The second constituent of the uterine mucous membrane, next in importance to the epithelium (parenchyma) is the stroma, which accommodates the epithelial structures and the lymph- and blood-vessels.—In the stroma we distinguish the delicate retiform framework (intercellular substance) and the cellular elements (stroma cells). The retiform framework is not always distinct, but under certain conditions, such as slight edema of the mucous membrane or dysmenorrheic endometritis, it may be quite well seen.—The stroma cells are round and resemble lymph-corpuscles. Under normal conditions the cell-body of these round cells can barely be seen or is invisible. The cell is completely filled by the round, well-stained nucleus. In addition to the spherical stroma cells we find in a normal mucosa, usually only in the neighborhood of vessels in the deeper layers of the mucous membrane, and surrounding the glands, spindle-shaped elements which can often be recognized only by their oval nuclei. In a slightly edematous mucosa the delicate processes by which the individual stroma

Stroma of the Uterine Mucosa.

elements are connected may be occasionally seen.—Owing to the similarity of the stroma cells to the cells of the lymph-glands, the uterine mucous membrane is designated a lymphoid, adenoid or cytogenous tissue.—The stroma of the infantile uterine mucosa consists of small round cells, as in the period of sexual maturity. After the climacteric, the mucous membrane is converted into the senile atrophic endometrium—the stroma cells disappear in part, while others are converted into spindle-shaped elements which arrange themselves in rows and produce a fibrous, cicatricial appearance. The mucous membrane presents the appearance of chronic interstitial change or cirrhosis (sclerosis).—The stroma, parenchyma, and epithelial structures atrophy.—Often a premature atrophy is observed (atrophia senilis præcox, senescentia præcox).

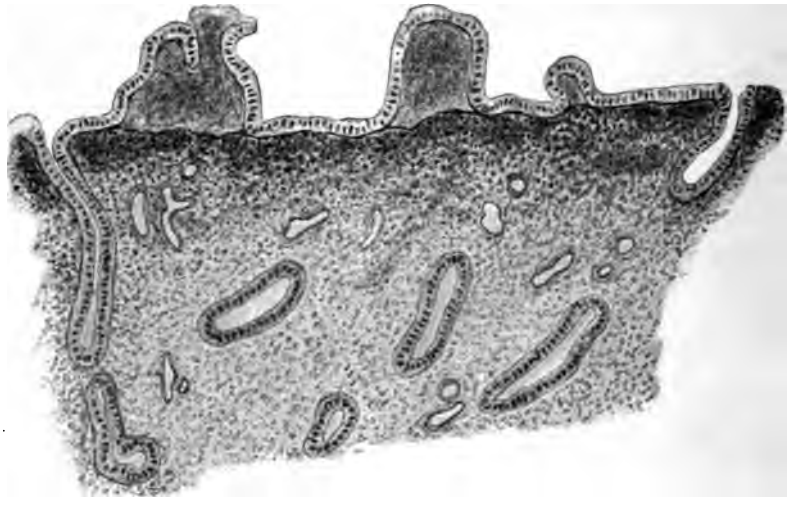

FIG. 71.—UTERINE MUCOUS MEMBRANE DURING MENSTRUATION, WITH EPITHELIAL HEMATOMATA. (Original.)

With the occurrence of sexual maturity and *pari passu* with the development of the uterus and its mucous membrane—not before, and often not until some time afterward — the regularly recurring physiologic process of **menstruation** (catamenia) begins.

Menstruation.

—Several stages may be distinguished in menstruation by anatomical and microscopic examination: First, there is great congestion of the vessels and, with it, swelling of the mucous membrane: the stroma becomes saturated with serum and loosened.—The second stage is that of hemorrhage (by diapedesis and rhexis): the blood is poured out into the tissue, on the surface of the uterine cavity and into the glands. Here and there on the surface of the epithelium there are seen irregular prominences of the epithelium due to subepithelial hemorrhage (the epithelial hematomata of Gebhard, Fig. 71). These hematomata may rupture and evacuate their

contents into the uterine cavity, and the epithelium may again become attached to the surface.—The hemorrhage into the tissue of the mucous membrane is pronounced in the upper portions near the surface epithelium. In microscopic preparations the mucous membrane everywhere in the upper portion appears brownish-red, in contrast to the more anemic, deeper lying portions, which appear pale.—The process of diapedesis and hemorrhage is followed by that of absorption of the blood which has been poured out into the tissue and has not been discharged outside of the body. Several days after menstruation granular, yellowish blood-pigment is found; this also disappears, however, in a short time, and the mucous membrane returns to its normal condition in a few days.—The epithelial cells which are destroyed or separated by the formation of hematomata or by the hemorrhage itself, are soon renewed or reattach themselves to the surface.—

Complete expulsion of the mucous membrane and systematic renewal of large masses of epithelium or connective tissue does not take place during menstruation, as was formerly supposed.—Physiologic processes (menstruation without loss of substance) must be sharply distinguished from pathologic processes (membranous endometritis), in which large portions, or even the upper layer of the entire uterine mucosa, are expelled, and the evacuated membranes represent a complete "cast" of the uterine cavity.—It is not correct to speak of gradual transitions or differences; in the case of the intestine the normal activity, from the etiologic standpoint alone, must be distinguished from pathologic (dysenteric) processes.—

Menstruation not Attended by Expulsion of Mucosa.

The so-called menstruation of new-born infants is an interesting phenomenon; a bloody discharge lasting several days sometimes occurs.—The mucous membrane (judging from the very rare accidental findings) microscopically presents a condition entirely analogous to that which has been described in the sexually mature individual. The diapedesis, in one case which has been observed, appeared to be very extensive and involved the entire mucous membrane, just as is in adults.—

Menstruation of the New-born.

A second alteration of the mucous membrane, which, like menstruation, must be regarded as a physiologic process or condition—the changes due to pregnancy—will be discussed separately (see below).

After the mucous membrane of the uterine body, the cervix and the epithelial covering of the vaginal portion have been studied, there remain the constituents of the uterine wall as well as of the peritoneal covering, and here also a division into body, cervix, and vaginal portion is to be made. The tissue of the

uterine body is chiefly composed of muscle. The connective tissue framework is insignificant compared to the massive development of the muscle fibres.—Microscopically the musculature consists of smooth muscle fibres which in longitudinal section represent spindle-shaped, narrow elements with uniform, rod-shaped nuclei. In rare cases, under very great magnification, a fine pattern may be made out in the muscle elements or their nuclei in the non-pregnant state. In the gravid uterus, and occasionally in myomata, which may, although in rare cases, produce an increase of the muscular elements in the organ, the greatly enlarged muscle fibres contain a finely granular protoplasm and one or two nucleoli in the enlarged, narrow, oval nucleus.—The muscle fibres of the sexually mature organ are arranged in bundles; the individual fibres are arranged regularly in the same direction within the bundles and undergo division, producing the picture of radiation and thus embracing other bundles. The fibres appear to form an interlacing network, like felt. The bundles themselves run in different directions. Hence the muscle bundles appear in a great many different planes—in the microscopic section—transverse, longitudinal and oblique. In transverse sections the muscle bundles form small, spherical structures corresponding to the transverse section of the muscle elements, and therefore appear like an aggregation of small, approximately round cells, except that the outlines are usually not so distinct as in the case of genuine round cells. The transverse sections of smooth muscle elements are also characterized by the somewhat greater refraction of the sarcolemma, and the transverse sections of the nuclei are often wanting because all the muscle elements are not always cut in the middle and the nuclei therefore do not appear in all the sections.—In oblique sections transitional forms between longitudinal and cross-sections are seen: short, spindle-shaped figures with narrow, and often spherical nuclei.—

Musculature of Corpus Uteri.

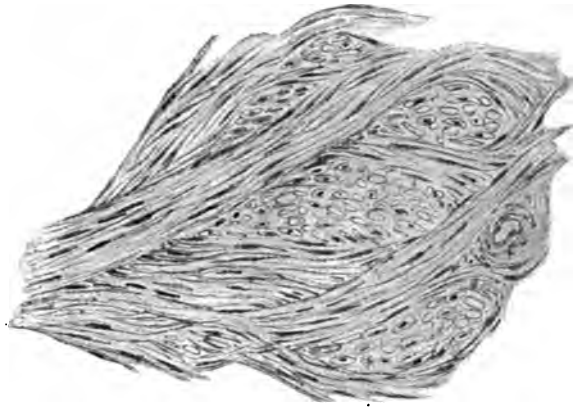

FIG. 72.—MUSCULATURE OF THE UTERINE BODY: Longitudinal and transverse muscle bundles. (Original.)

The arrangement of the bundles and strands of muscle fibres with respect to one another in the sexually mature organ appears to follow no rule whatever. The different bundles appear to form a closely interlacing network, like felt. There is no uniform arrangement in layers (circular and longitudinal layers, as in the intestine), although it is customary to describe in the uterus an outer longitudinal and an inner circular layer, and between the two the remaining interlacing and crossing muscle bundles—the general mass of the musculature.—The history of the development of the uterus shows that the musculature is derived from a number of regular layers (von Hoffmann), which survive in the tube. In the sexually mature organ the theory of regularly arranged longitudinal and circular layers is untenable.—

Several muscle bundles unite to form groups, and within the groups the individual bundles interlace and cross one another in various directions.—The musculature is composed of large and small groups of muscle bundles in close opposition, and the groups are intimately connected by stroma.—A section through the musculature of the body of the uterus represents the picture of a uniformly interlacing tissue, exhibiting here and there whitish or asbestos-like strands which consist of longitudinal sections (longitudinal muscle bundles).—

Under normal, as well as under pathologic conditions the apparently irregular arrangement of the musculature of the uterine body may be replaced by a uniform arrangement in layers—a lamellar arrangement. As the uterus enlarges through the growth of the fetus during pregnancy or the presence of a myoma, the musculature, which is apparently inextricably tangled, unfolds and becomes arranged in uniform layers (longitudinal layers, lamellæ) in the case of pregnancy throughout the organ, or in myoma uteri only around the tumor. In the case of very large, or multiple, fair-sized myomata the structure of the entire body sometimes becomes lamellar. It is owing to this lamellar metamorphosis of the musculature, usually around the myoma, that the tumor can be enucleated (so-called capsule-formation of the myoma). The lamellæ are thin and often can be readily separated and torn. The myoma is connected to the musculature by individual lamellæ. By circumscribed proliferation in the muscular layers (lamellæ) which are connected with the myoma the tumor enlarges (growth by apposition) and is also more readily isolated.—Finally, especially after growth has ceased, the pressure of the myoma on the nearest individual muscle layers may produce a certain atrophy of these layers, and in this way a kind of encapsulation may be simulated. True encapsulation ("capsule-formation") does not occur in myomata.—

Lamellar Arrangement of the Musculature when the Uterus is Enlarged.

So-called Capsule-formation in Myomata.

The lamellar structure which results from enlargement of the uterus is not composed entirely of parallel muscle layers; with a little care it is possible everywhere to distinguish bundles running obliquely from the longitudinal lamellæ and strands of tissue connecting adjacent longitudinal layers. In this way the so-called muscle rhomboids are formed.—These muscle strands connecting the longitudinal lamellæ, and the somewhat different arrangement of the musculature in the muscle lamellæ and connecting strands of muscle, explain the various effects that are produced when the muscle contracts.—In the gravid uterus it may be shown that the closely packed muscle lamellæ in the upper portion of the uterine body are firmly attached to the peritoneum, while in the lower portion of the body, the so-called lower uterine segment, only a few muscle lamellæ are thus attached; hence firm fixation of peritoneum above, and loose connection with the organ below.—The boundary between the loose attachment of the muscle lamellæ and the closely packed lamellæ which are firmly attached to the peritoneum is called the line of firm attachment of the peritoneum. (F. A.)—

Muscle-rhomboids.

Line of Firm Attachment of the Peritoneum.

Musculature of the New-born.

The same ill-defined character is observed in the muscle bundles of the uterus of the child and of the new-born infant. The strands of muscle fibre are much thinner and the microscopic picture is therefore much less complex.—After the climacteric, in old age, the muscle undergoes marked atrophy. The connective tissue becomes apparently increased and the organ reduced in size.—The blood-vessels often show marked thickening of their walls (sclerosis), besides myxomatous degeneration.—

In Old Age.

The cervical tissue consists for the most part of connective tissue; the stroma of the cervix receives strands of muscle fibres from the body, which divide and enter the firm connective tissue in various directions. Immediately underneath the mucous membrane of the cervix distinct strands of muscle bundles can be demonstrated. In the outer portion these strands are exclusively longitudinal and merge with the muscular tissue of the vagina. In the middle of the cervix, and becoming less numerous as the surface of the vaginal portion is approached, there are regular strands of muscle fibres, usually, however, only where there are blood-vessels.—The wall of the cervix does not undergo a definite change, particularly a lamellar change, during pregnancy, as in the case of the uterine body.

Cervical Tissue.

Tissue of the Portio Vaginalis.

The vaginal portion (see above) consists of firm connective tissue, containing a few muscular elements. The connective tissue lies underneath the stratified squamous epithelium and is made up of uniform fibres with abundant nuclei. In deep layers

more robust and wavy masses of connective tissue, as well as some strands of muscle tissue are found. In the layers near the epithelium elastic fibres have been demonstrated (Dührssen).

The arterial vessels in the mucous membrane of the body of the uterus are generally but poorly supplied with muscular tissue; after pathologic processes, however, the walls of the vessels, which are often quite tortuous, may undergo thickening.— In the cervix as well as in the vaginal portion the walls of the blood-vessels are better developed.—The uterine body of the child and of the new-born infant contains wide, well-developed, often cavernous vessels in the layers underneath the peritoneum.—The same picture of "cavernous" tissue is not infrequently seen in the tissues of the vaginal portion, particularly the layers situated near the epithelium.— The uterus is abundantly supplied with lymphatics, which in the mucous membrane take the form of simple clefts. In the tissue of the individual portions of the organ they are covered with endothelium and unite to form large lymphatic trunks on both sides of the organ (see lymphatics of the uterus).

Vessels: (a) Blood-vessels.

(b) Lymph-vessels.

The greater part of the uterus is covered with peritoneum which, like the remainder of the membrane, is covered with epithelium (endothelium); the latter may be completely cylindrical, and glandular depressions may extend beyond the peritoneal tissue into the muscularis (Rob. Meyer).—The peritoneum consists chiefly of connective tissue, with a few longitudinal smooth muscle fibres which, near the tubes, become circular.—The peritoneal covering of the uterus in the sexually mature organ is, for the most part, firmly attached; on the anterior wall the boundary-line of firm attachment forms a parabola, the apex of which is lowest in the median line, about 1 cm. above the region of the internal os, while the two lateral curves pass to the region underneath the round ligament. On the posterior wall the line of firm attachment of the peritoneum is much lower; here the apex of the parabola is usually at the level of the middle of the cervix, and the lateral curves pass to the region underneath the ovarian ligaments. In the remaining portions of the uterus covered with peritoneum the attachment is loose.—

Peritoneum.

Peritoneal Attachment: (a) to the Anterior Wall.

(b) To the Posterior Wall.

The peritoneum is intimately connected with the uterine muscle. In the gravid uterus the lamellar strands of muscle fibres are seen to originate in the peritoneum, entering the uterine wall from above downward and inward. At the point where the peritoneum is firmly attached, the origins of the muscle lamellæ are seen close together; below, where the attachment is loose, only a few large muscle lamellæ, widely

Attachment of Uterine Muscle to Peritoneum.

separated from one another, without much tendency to interlace, are seen. Above, numerous small rhomboids of muscle tissue; below, a few large muscular rhomboids.—

Firm and Loose Attachment of the Peritoneum.

This firm and loose attachment of the peritoneum can be seen also in the uterus of the child, as well as of the new-born infant, just as in the sexually mature organ the line of firm attachment is situated a little above the level of the internal os.—That part of the uterine body which lies between the line of firm attachment of the peritoneum and the internal os is described separately. During pregnancy this portion increases with the size of the uterus and is known as the lower uterine segment. (The lower uterine segment will be referred to later).—

Lower Uterine Segment.

The uterus further presents for study Gartner's ducts, which

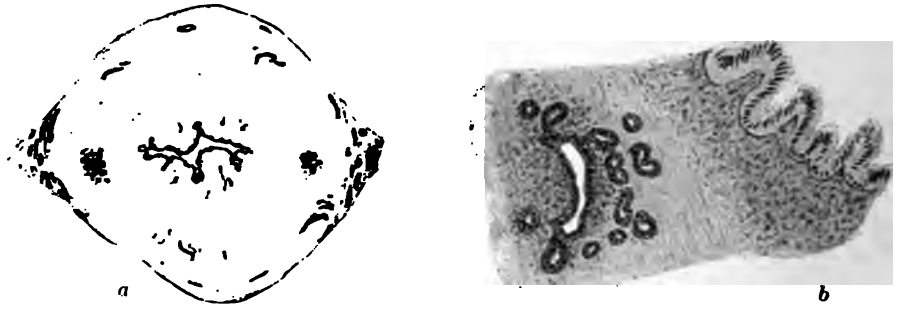

FIG. 73.—*a*. TRANSVERSE SECTION THROUGH THE CERVIX OF A NEW-BORN CHILD. On each side of the lumen of the cervix Gartner's ducts subdivide laterally. *b*. Under higher magnification the cervical mucous membrane with cervical epithelium does not take the stain (in this section the nuclei are not regularly situated near the base). Gartner's canal with epithelium resembling that of the body of the uterus. (Original.)

are not constant, or their remains. They enter the uterine muscle from the side (at, or a little above, the level of the internal os) when they are well preserved; are deflected slightly downward and inward, and pass over the vaginal vault in a slightly recurrent arch to the vagina; here they deviate to one side and slightly forward, and end in their orifices at the level of the hymen. Sometimes Gartner's ducts are merely simple canals, and occasionally a canal is present on one side only. Sometimes the ducts form remarkable ramifications, due to lateral ducts that are given off and subsequently undergo subdivision; the ramifications have slightly dilated extremities (Rob. Meyer, Fig. 73, *a*.) The epithelium is cylindrical and resembles the uterine epithelium in the position of the nucleus and its staining qualities. Gartner's duct is surrounded by an envelope of small-celled connective tissue.—The malignant degenerations of the epithelial constituents are interesting (Rob. Meyer). Some vaginal cysts, which are seated in front and laterally, are attributed to Gartner's ducts.—

Gartner's Ducts.

The **tubes** present first a peritoneal covering; second, a rich layer of muscle tissue, longitudinal near the outside and circular within; and third, the mucous membrane.—The character of the tube varies in its different segments. Aside from the interstitial portion (the portion within the uterine wall), the individual segments vary in thickness; the mucous membrane of the interstitial portion and of the part situated near the uterus is wholly, or almost wholly, devoid of folds; the transverse section usually appears stellate. The epithelium is cylindrical, forms a single layer, and resembles the uterine epithelium; in recent preparations cilia are seen.—In the section near the abdominal orifice (fimbriæ) the mucous membrane exhibits well developed folds, and in cross-section the picture appears almost villous or glandular, suggesting the picture of malignant adenoma of the uterine body (Fig. 74, *a*) (see below). The normal tube contains no glands, although the microscopic picture appears glandular. But, as in the case of all surfaces covered with cylindrical epithelium, pathologic processes may lead to proliferation of the epithelium and the formation of depressions or glands (see below). Generally speaking, the Fallopian tube does not alter during menstruation or in pregnancy (except in tubal pregnancy, see below); cases have been described, however, in which the entire tube took part in menstruation, as well as in the changes incident to pregnancy.

Tubes.

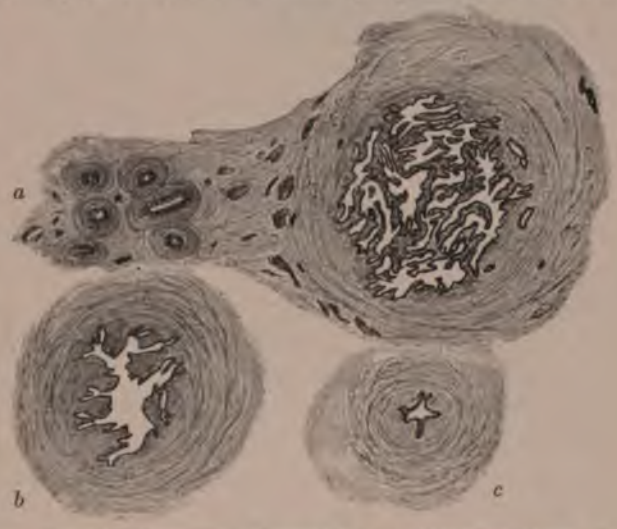

FIG. 74.—TRANSVERSE SECTIONS OF THE FALLOPIAN TUBES. *a*. At the abdominal orifice, rich folds of mucous membrane. *b*. In the middle of the tube the folds of mucous membrane are not so well developed. *c*. Tube within the uterus (interstitial portion), a simple canal. At *a* the mesosalpinx contains parovarian tubules. (Original.)

The Fallopian tube in children and in new-born infants does not differ in its outward shape from that of adults, but is, of course, smaller in size; but owing to the greater development of the circular muscle bundles and the slight development of the longitudinal bundles, the Fallopian tube is more tortuous than during sexual maturity.—

Preparations of Fallopian tubes frequently exhibit the remains of parovarian ducts in the mesosalpinx, as epithelial ducts with cylindrical epithelium surrounded by well-developed, circular muscle layers.

Diagnosis of Normal Pregnancy.

Although the diagnosis of pregnancy does not strictly belong to gynecological diagnosis, it must nevertheless be discussed in this connection, partly because it is made in exactly the same way as the diagnosis of gynecological diseases, particularly during the first months of pregnancy, *i.e.*, by combined examination, and partly because the findings in a number of gynecological affections are so similar to the conditions found in pregnancy that the latter always plays a most important part in the differential diagnosis. The diagnosis of normal pregnancy is particularly important for the physician because it is a diagnosis that can be confirmed better than any other. "Nunquam fere magis periclitatur fama medici, quam ubi agitur de graviditate determinanda," says van Swieten in speaking of the annoyances that may accrue to the physician from a mistaken diagnosis of pregnancy. It is therefore the part of wisdom on the part of the physician not to announce or exclude this condition, which brings such a momentous change into a woman's life, until the diagnosis is established beyond the possibility of a mistake. If there is any doubt, it is wiser to wait a month longer. A woman does not usually expect a diagnosis of pregnancy before the third or fourth month, and at this period the diagnosis can usually be made with certainty. Before that date it must always be dubious in the hands of any but a very experienced practitioner.

The diagnosis of pregnancy is absolutely certain when the presence of a child within the uterus can be demonstrated. The first signs of this, however, cannot be positively determined until about the middle of pregnancy, so that they are available only for the second half; during the first four or five months the diagnosis must be based solely on changes in the maternal genitalia, and for this reason there is a fundamental difference between the diagnosis in the first and the diagnosis in the second half of gestation.

The **diagnosis of pregnancy during the first half** of gestation is based on the demonstration of changes that develop in the genitalia under the influence of an increased blood supply and the growth of the ovum within the uterus, which begins at the time of impregnation, and consists in changes that take place in the blood- and lymph-vessels as well as in hypertrophic conditions of the mucous membranes and the uterine muscle. The uterus itself is affected by the growing ovum, which is attached in the neighborhood of the tubal orifices and separates the two walls of the uterus, but at first does not grow at the same rate

as the uterus itself. The periphery of the ovum does not everywhere reach the uterine wall until the end of the third month, when the decidua reflexa joins the decidua vera. From this time on the uterus and ovum grow *pari passu* and the union of the two fetal membranes may take place at any time between the fifth and sixth months.

The diagnosis of pregnancy must, under all circumstances, be based exclusively on the objective examination.

The following changes are utilized in making the diagnosis:

The introitus, after a few weeks, frequently shows a slight bluish discoloration of the mucous membrane of both vaginal walls, forming at the hymen a sharp contrast with the normal color of the mucous membrane of the vestibulum. The bluish discoloration is most marked at the fold surrounding the urethral meatus and on each side, where it merges with the lateral wall of the vagina. The discoloration is a matter of individuality and may be absent even when the fetus is living, particularly in primiparæ, while in multiparæ it is, generally speaking, more distinct. During the later months the color increases in intensity. A marked dilatation of the veins is superadded, and the introitus presents a characteristic bluish-black appearance, so that a single glance suffices to establish the diagnosis. Not infrequently a slight dilatation persists after parturition, so that in multiparæ a slight bluish introitus may be seen even in the absence of a pregnancy.

Changes at the Introitus.

A bluish discoloration at the introitus does not belong to pregnancy exclusively, being observed also in the presence of large tumors of the uterus and ovaries, when they produce great vascularity in the neighborhood.

Case 4. In an elderly person, with an ovarian tumor of the shape and consistency of a gravid uterus, the diagnosis was extremely difficult and for some time I considered pregnancy because the introitus was a dark blue, such as is usually seen in the last months of pregnancy.

Bluish discoloration at the introitus of the vagina is also occasionally observed in diseases associated with circulatory disturbances in the abdominal veins (cirrhosis of the liver, cardiac and pulmonary diseases).

Similar, although less pronounced, changes are seen in the mucous membrane of the vagina. It appears livid, often of a reddish-blue and somewhat glistening, owing to its turgescence. The increased metabolism in the vaginal mucous membrane manifests itself in an abundant desquamation of the squamous epithelium, covering the surface with whitish shreds. The cervix also secretes somewhat more mucus than usual, so that the increased vaginal secretion is one of the regular phenomena of pregnancy. The mucous membrane feels soft, loose, and velvety;

Changes in the Vagina.

pulsating vessels are not infrequently seen in the vaginal vault. But even these signs are subject to individual variations and may be completely absent even in the presence of a living ovum; in multiparæ they are usually more distinct. On the other hand, they may undoubtedly occur in the absence of pregnancy, particularly with large tumors, especially myomata; in recent inflammations in the neighborhood of the vagina; in catarrh. A bluish discoloration of the vagina is also occasionally seen with an hematocele.

Changes in the Portio Vaginalis.

The changes in the mucous membrane are most distinct and appear earliest in the vaginal portion of the cervix. The softening and the bluish discoloration of the mucous membrane are frequently the first signs of pregnancy. The mucous membrane is often intensely blue, and erosions show a deep purple color; it feels very soft and boggy, while the subjacent cervical tissue at first retains its normal consistency. During the late months, however, the latter also shares in the general softening. Old lacerations of the cervix become much more distinct during pregnancy because the cicatricial tissue forms a contrast to the softer surroundings. In primiparæ the external os becomes rounder. Softening of the vaginal portion is not a positive sign of pregnancy, as it is also quite distinct in chronic fungous endometritis and metritis, and in recent inflammations in the neighborhood of the uterus.

Enlargement of the Uterus.

The most important changes produced by pregnancy are found in the uterus itself and are: an increase in size, and softening. The enlargement may be detected by a practised hand as early as the second month; in the third month it can hardly escape the notice of even a less experienced examiner. The earliest change of shape demonstrable in the gravid uterus consists in a slight enlargement of its transverse diameter, caused by the increase in the thickness of the lateral walls; but the increase in the diameter does not become distinct until the sagittal diameter also increases and the two walls are separated by the growing ovum. As long as the uterus is still in the pelvis, the enlargement is easily demonstrated; as it increases in size, however, and rises out of the pelvis, *i.e.*, in the fourth and fifth months, the diagnosis of pregnancy becomes difficult because one cannot be certain that the distinctly palpable tumor is the uterus; for about this time the gravid uterus usually becomes greatly anteflexed, and, as the vaginal portion is therefore situated posteriorly at the pelvic wall, it is often impossible to recognize with certainty where the cervix joins the uterine body, particularly if the uterine segment is very much softened (Fig. 75). Under these circumstances one is often tempted to mistake the gravid uterus for a tumor and to assume, by the direction of the vaginal portion, that the uterus is behind it in

retroversion. It is often absolutely impossible to demonstrate the cervical angle through the anterior vaginal vault, and the connection between the cervix and the uterine body can be recognized with certainty only by palpating upward along the lateral margin of the vaginal portion of the cervix.

The softening of the uterus is subject to wide individual variation. The organ is sometimes so soft that it cannot be felt at all, or the outlines of its resistance can be differentiated from the intestines

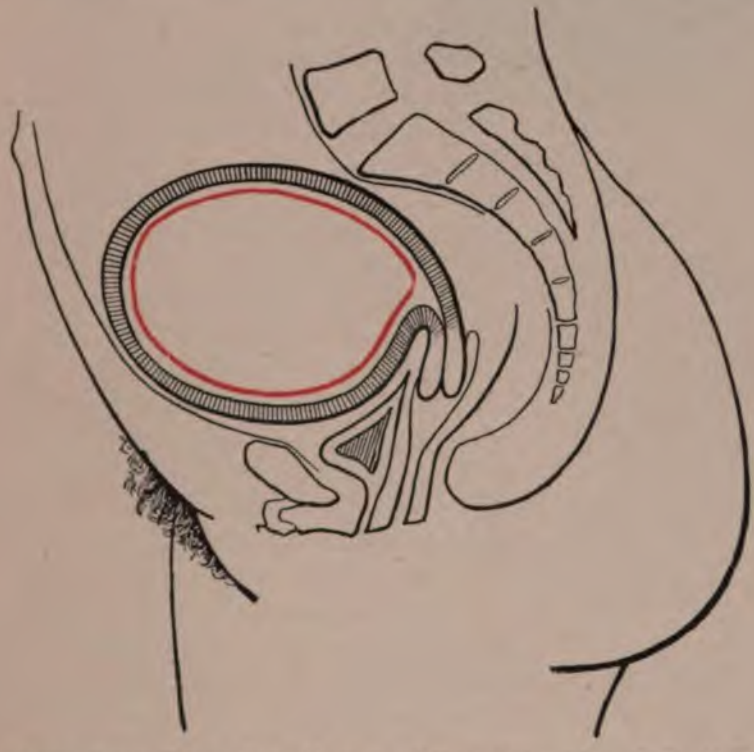

Fig. 75.—Gravid Uterus in the Fifth Month in Marked Anteflexion. P.-F. ⅓. (Original.)

only by the very lightest pressure. In such a case, if the entire uterus is grasped between the widespread fingers and the intra-uterine tension increased by uniform pressure in all directions, palpation becomes very much easier. On the other hand, softening may be entirely absent in a normal pregnancy; in that case the vaginal portion and the vagina are, as a rule, less blue and less succulent. The slightest grade of softening of the uterus can be distinctly recognized in such cases by grasping the organ between both hands and making slight pressure. The slightest degree of elasticity, the merest suspicion of yielding (impressibility) indicates softening, whereas the non-gravid uterus is hard and unyielding. In primiparæ and in the

Softening of the Uterus.

presence of complications with mild grades of metritis, softening of the uterus is very slight. Not infrequently the gravid uterus may be felt in the midst of contraction; the organ feels hard and tense, but soon becomes soft under the fingers. This change in consistency is the most positive sign of pregnancy. Sometimes a gravid uterus that shows but little softening presents irregularities in its outline, ridges and projections, caused by partial overlapping of the musculature. These irregularities sometimes have the shape of interstitial myomata, for which they may be mistaken, or they may simulate fetal parts felt through the wall. As palpation is continued, however, they disappear or change their shape. When these partial contractions form in a circle at the cornu of the uterus, portions of the organ may be constricted off from the main part and simulate cystic tumors of the adnexæ. As a rule, these contractions are transitory and the picture soon undergoes a complete change.

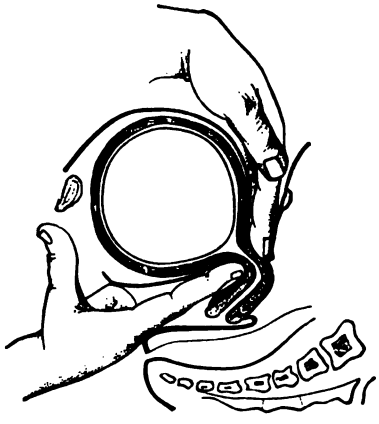

FIG. 76.—POSITION OF THE HANDS IN EXAMINING FOR HEGAR'S SIGN OF PREGNANCY (after Hegar).

The softening of the uterus is most distinct in the lower uterine segment before it is occupied by the ovum. While the upper portion of the uterus, on account of the presence of the ovum, becomes more tense, and the cervix, owing to the slight degree of succulence, forms a sharp contrast with it, the intermediate portion of the uterus becomes so thin and pliable that it often escapes the sense of touch altogether because the two softened walls of the uterus are in contact. If the uterus is in the normal position, and the internal hand is introduced into the anterior vaginal vault while the external hand is placed on the posterior surface of the uterus, immediately above the internal os, the two hands apparently touch each other (Fig. 76).

NOTE. This obliteration of the lower uterine segment can also be demonstrated during the later months when it is completely occupied by the ovum, because the movable portion of the ovum, the amniotic fluid, yields to the pressure of the finger. The coincident distention of the body of the uterus, although it can barely be demonstrated by palpation, is in proportion to the compression of the lower uterine segment. In this sense, therefore, the so-called Hegar's sign is the earliest sign of pregnancy directly dependent on the ovum, and is exceedingly important in the diagnosis of early pregnancy.

The greater the softening of the uterus as a whole, the more distinct will be the obliteration of the lower uterine segment; but it is present also, as a rule, when softening of the entire organ is only

moderate. In my opinion the sign is not so important in the diagnosis of a normal pregnancy as it is in cases which present special difficulties, particularly when there is an absence of softening. I have found it exceedingly useful in the diagnosis of pregnancy with a dead fetus, and in retention after abortion; in very early pregnancy also it is at this point that the first signs of softening are most frequently found. For the practitioner a familiarity with this peculiar characteristic of the lower uterine segment is particularly important because it is the source of the great difficulties that are occasionally encountered in the diagnosis of pregnancy, such, for example, as the already mentioned anteflexion of the gravid uterus and the difficulty of distinguishing between normal and extra-uterine pregnancy, which is by no means rare, particularly when the body of the uterus is lateral or posterior to the ectopic product.

The suspicion of pregnancy may be aroused by the presence of an irregular bulging of a certain portion of the body of the uterus in connection with softening. These prominences are produced by excessive growth of that portion of the uterus which gives attachment to the ovum. They are most readily recognized when they are situated in one of the cornua. The corresponding cornu then appears prominent and dilated, while the other retains its normal shape. In connection with this asymmetry one occasionally feels delicate furrows running in a sagittal direction between the two different sections of the uterus. Softening and compressibility of the prominent portions are also necessary for a diagnosis of pregnancy, because the same changes in the shape of the uterus may be produced by a myoma.

Local Bulging of the Uterus.

The certainty of a diagnosis of pregnancy is proportionate to the number of the above mentioned signs that can be demonstrated. The examiner should not content himself with one sign, but should examine all the organs that have been mentioned, attaching the greatest importance to the changes in the uterus.

The **diagnosis of pregnancy during the second half** is based on demonstration of the fetus.

The earliest fetal sign is fetal movement, which may often be demonstrated at the end of the fourth month with the stethoscope, as a soft scratching or crackling, scraping sound; or even as a slight blow, particularly after the uterus has been forcibly compressed a few times. During the later months the palpable and visible movements of the feet and the short, vigorous blows of the trunk constitute a positive fetal sign.

Fetal Movements.

The fetal heart sounds can occasionally be heard by patient and attentive auscultation toward the end of the fourth month. As

a rule, the degree of certainty necessary for a diagnosis can be obtained only at the end of the fifth month, or about the middle of pregnancy.

Fetal Heart Sounds.

As, owing to the constant change in the position of the fetus, the position of the heart sounds is variable, the entire surface of the uterus must be explored with the stethoscope. The sound is double, very low, and the rate is about 140 to 160 per minute. The sounds increase in loudness with the progress of pregnancy, and their position, corresponding to that of the fetus, also becomes more constant.

The conditions necessary for successfully palpating the fetal parts are not present before the middle of pregnancy; previous to that time they are surrounded by the amniotic fluid, and lie deep within the uterus, which is still hard and incompressible; but about this time the fetal head can occasionally be felt through the vagina, if it happens to be in apposition with the anterior wall and does not escape from the palpating fingers too quickly. By the sixth and seventh month the fetal parts have become quite hard, although they are still very movable, and can be demonstrated by external palpation; and as time goes on, the entire fetus becomes gradually more distinct so that all of its parts can be recognized. (For the methods to be employed for this purpose the reader is referred to works on obstetrical diagnosis.)

Fetal Parts.

Certain changes in the breasts develop as early as the first month of pregnancy. They consist in swelling and increased activity of the glands, which become hard and on pressure exude colostrum. At the same time Montgomery's glands, *i.e.*, the sebaceous glands in the areola, become enlarged, and glistening blue subcutaneous veins make their appearance. These changes produce a feeling of tension and pricking in the breasts, which early attract the pregnant woman's attention; in nulliparous women this sign is more important than in multiparæ. Its diagnostic value is, however, materially diminished by the fact that it is also observed quite frequently in cases of large myomata and ovarian tumors, and occasionally during menstruation.

Changes in the Breasts.

The history is of minor value in the diagnosis of pregnancy as compared with the objective examination; it should be used as a support to the diagnosis arrived at by the visible signs, but should never form the foundation of the diagnosis. The only symptom of value in the diagnosis is the cessation of menstruation. This sign is of such tremendous importance in the eyes of the laity that every woman who has ever had sexual intercourse at once suspects pregnancy if she misses her periods. For a physician this method of making a diagnosis is wrong. If, however, a woman who has

Anamnesis.

always been absolutely regular in her menstruation suddenly misses a period without any previous gradual diminution in the flow, or general or local symptoms of indisposition, it is probable that she is pregnant; but the diagnosis can never be positive because even in perfect health the woman's menstruation may be delayed weeks or months as the result of some psychic impression, acute circulatory disturbance, overexertion, and the like; while local, and particularly general diseases are a still more frequent cause of amenorrhea. For determining the date of the beginning of pregnancy, the sign is even less reliable, because a woman may become pregnant during a period of amenorrhea due to other causes, such as lactation, so that the pregnancy may be much more recent than the period of amenorrhea would indicate. The value of the sign is also restricted by the fact that a woman may menstruate during pregnancy. A menstrual hemorrhage from the endometrium may continue for a few months, or very rarely until the end of pregnancy, although to be sure, the bleeding differs from a normal menstruation by its duration and the pale and watery appearance of the blood. On the other hand, hemorrhages due to disease of the uterus or fetal membranes are quite frequent, and as such hemorrhages are usually described by women as "periods," the patient's statement that the menstruation has not ceased may mislead the physician. By a careful interrogation concerning the type and character of the bleeding the mystery may be cleared up.

The symptoms of nausea and frequent vomiting have a certain diagnostic value, although these symptoms are also complained of by otherwise healthy women, particularly in connection with amenorrhea. A patient's statements that she feels fetal movements must be accepted with great caution, because intestinal movements, pulsation of arteries, the movements of a tumor and the like, are frequently mistaken for this phenomenon.

The practitioner who depends too much on a patient's statements, or attaches more importance to them than to the results of objective examination, cannot hope to escape errors in diagnosis; but he who assigns them their true place will always be glad to find in them the desired confirmation of a diagnosis based on objective signs.

Differential Diagnosis.—The differential diagnosis covers a very wide field, since every variety of abdominal tumor may be, and in fact has been, mistaken for pregnancy. As pregnancy is the most frequent cause of the development of an abdominal tumor, we advise one who is not an expert diagnostician always to think of pregnancy in diagnosing such a tumor, and to include pregnancy in his differential diagnosis. By so doing he will not run so much danger of failing to recognize an existing pregnancy.

Differential Diagnosis.

Differential diagnosis plays a more important part, and encounters many more difficulties during the first half of pregnancy because at this time positive fetal signs are as a rule absent, and the diagnosis must be based solely on the shape and consistency of the uterus. The following conditions must be considered:

Chronic metritis may be mistaken for pregnancy because it also gives rise to enlargement of the uterus and, especially in recent cases, to a certain degree of softening, particularly as the vaginal portion may appear succulent and of a bluish color. The mistake, however, is likely to arise only during the first two or three months, as inflammatory swelling rarely causes enlargement of the uterus. In chronic metritis the uterus is more flat and not so much thickened, non-elastic, and resistant to the pressure of the fingers. The inflammatory thickening also involves the cervix and the lower uterine segment, so that Hegar's sign is absent. The vagina and introitus present no alterations. In doubtful cases the only safe course is to observe the further growth of the uterus, and it is always best to wait at least four weeks, because slight differences in size cannot be detected by palpation. The diagnosis will frequently have to be confirmed by the history, showing that menstruation continues to be normal.

Hematometra plays an important rôle in the differential diagnosis among physicians, apparently because it is also associated with amenorrhea. In actual practice the condition, on account of its great rarity, hardly needs to be considered. The enlargement of the uterus in hematometra produces a uniform, spherical shape, whereas the gravid uterus is broader through the body. The cervix frequently takes part in the distention by the retained blood, becomes balloon-shaped and merges with the uterine body. The chief difference in the two conditions, however, is found in the consistency. In hematometra the enlargement of the uterus is due entirely to its contents, and it is therefore tense and distended like a balloon; never soft and doughy. It is only in those rare cases in which part of the retained blood is absorbed that a soft consistency may be produced and simulate that of pregnancy. If the occlusion at the cervix or vagina which has produced the hematometra can be demonstrated, the diagnosis is assured. The history may aid the diagnosis, inasmuch as the development of hematometra requires a much longer period of amenorrhea than is necessary to produce the enlargement of pregnancy.

For the differential diagnosis from myoma the reader is referred to the chapter on that subject. For extra-uterine pregnancy, see page 143.

During the second half of pregnancy diagnostic errors are less frequent because at least one of the fetal signs is usually available; but as the heart sounds are often overlooked, or cannot be

found, and the fetal parts are not infrequently mistaken for something else, the literature of diagnostic mistakes is quite large. The difficulties are increased when the fetus is dead, the heart sounds are no longer present, and the fetal parts can no longer be distinctly palpated. It is needless to say that at this period the conditions to be considered in the differential diagnosis are large tumors, and other changes must therefore be taken into account.

Quite often a woman supposes herself pregnant because her abdomen increases in size owing to an increase of the panniculus adiposus, particularly if at the same time the menstruation ceases, as, for example, at the beginning of the menopause. Pronounced meteorism and ascites may also arouse the suspicion of pregnancy. Careful percussion and palpation and finding a uterus of normal size will suffice to clear up the diagnosis.

Greater difficulties are encountered in the differential diagnosis from large myoma, ovarian tumors, and advanced extra-uterine pregnancy.

In this connection I repeat that there is no better way to clear up a doubtful case of pregnancy than to observe the growth of the uterus. My experience with the mistakes of practitioners teaches me that during the first half, pregnancy is more frequently overlooked, and the existing enlargement of the uterus mistaken for a myoma or an inflammatory swelling; while in the second half, neoplasms are more often erroneously diagnosed as pregnancies, either because the physician has been misled by the patient's suspicions or because pregnancy appears to him the most probable diagnosis.

Diagnosis of the Disturbances of Pregnancy.

Of equal importance as normal pregnancy to the gynecologic diagnostician are the many disturbances which occur during the pregnant state and which are characterized by definite gynecologic palpatory findings, and often need to be taken into consideration in the differential diagnosis of cases properly belonging to gynecology. They shall therefore receive attention in this place.

Diagnosis of Pregnancy with a Dead Fetus.

If the fetus dies during pregnancy it may be retained in the uterus for weeks and months, even beyond the term of normal gestation (missed abortion and missed labor). Cessation of the fetal movements and of increase in the size of the abdomen in the presence of an almost certain pregnancy, persistent hemorrhages, or disturbances of the general health almost always cause the patient to consult a physician, so that the diagnosis of this condition is of great practical importance.

The diagnosis is easy in proportion as the pregnancy is advanced; during the last months particularly it presents no difficulties whatever if, on repeated examination, no heart-sounds are heard or fetal movements can be demonstrated, and their absence cannot be explained by hydramnion; or the woman states that the fetal movements, which she had always felt quite distinctly, suddenly disappeared and the abdomen ceased to grow. If the fetus is retained several months, the fetal parts and even the head become so soft that they can no longer be recognized with certainty through the uterine wall by palpation. As, in addition, fetal sounds and fetal movements, in fact all the fetal signs of pregnancy are absent, the diagnosis of pregnancy may be doubtful, and at this period of gestation it can be made only by changes in the genitalia, especially by the softening of the enlarged uterus.

Diagnosis in the Second Half of Pregnancy.

During the first half of pregnancy fetal death can be recognized only by certain definite maternal signs, chiefly a disappearance of the softening and discoloration of the mucous membrane. The introitus and the vagina present practically no bluish discoloration at all and sometimes are slightly reddened. There is no softening of the vagina, or the softening is exceedingly slight for the corresponding period of gestation; and the disappearance of the signs of pregnancy is even more conspicuous in the vaginal portion. The uterus no longer feels soft and doughy; it becomes harder

Diagnosis in the First Half of Pregnancy.

and at the most its walls retain a certain degree of indentability which is preserved more at the lower uterine segment than elsewhere. In a few cases the elastic softening, which characterizes the gravid uterus with a living fetus, is replaced by distinct fluctuation. The greater the interval that has elapsed since the death of the fetus, the more complete will be the disappearance of all signs of pregnancy. As the softening of the uterus even with a living fetus varies greatly in individual cases, its absence cannot be taken as a positive sign of fetal death; there must be absolute proof that softening had been present and that it has subsided. A most reliable sign is the arrest in the growth of the uterus; and if the fetus has been retained for some time, a moderate diminution in size, due to absorption of the amniotic fluid, mummification of the fetus, and involution of the uterine wall, is noticed. The arrest in the growth of the uterus produces a discrepancy between the size of the organ and the calculated period of pregnancy which, of course, increases in proportion to the length of time that the ovum is retained. This apparently very reliable sign unfortunately loses some of its diagnostic value by the fact that women not infrequently conceive during a protracted period of amenorrhea, for example, during lactation, or after convalescence from typhoid fever. In this way a discrepancy arises between the duration of amenorrhea and the size of the uterus, a discrepancy which, however, does not justify a diagnosis of fetal death; the more pronounced this discrepancy, the more probable it is that conception has taken place during amenorrhea. Personal observation of the arrest in the growth of the uterus is the only absolutely certain method of arriving at a diagnosis; this, however, necessitates a period of observation of at least several weeks. It is, therefore, a good rule never to make a diagnosis of fetal death during the first half of pregnancy after the first examination, and to withhold one's opinion until further enlargement of the uterus has been excluded by personal observation at a second examination, made some time after the first. I have occasionally seen mistakes occur in estimating the size of the uterus because it was palpated during a labor pain.

The method of making a diagnosis of fetal death is illustrated by the following case:

Case 5. Mrs. R. presented herself on the 11th of December, 1895, because she no longer noticed any increase in the size of the abdomen, although she had been supposed to be pregnant. The last menstruation occurred about the middle of June. In October she says she passed blood and mucus for a few days, accompanied by labor pains. Examination revealed a very much softened vagina and vaginal portion, and a normally situated uterus about the size of a fist, round and of soft consistency, with distinct softening of the lower uterine segment. Pregnancy since June with a living fetus was excluded on account of the small size of the uterus. It seemed to me improbable, on account of the marked softening of the genitalia, that the fetus had been expelled unwittingly during menorrhagia and that the placenta had been retained for almost two months. The diagnosis lay between a preg-

nancy with a dead fetus dating from June, or a pregnancy with a living fetus of about three months' duration, which therefore must have begun during a period of amenorrhea. On account of the distinct softening I would have adopted the latter view at once, particularly as the patient did not complain of a single symptom, had it not been for the statement of a very experienced gynecologist who, toward the end of August, had definitely diagnosed a pregnancy of about two or three months' duration. For this reason pregnancy with a dead fetus was the most probable diagnosis, in spite of the remarkable softening of the tissues, and I decided to wait four or five weeks before giving a positive diagnosis. On the 13th of January, 1896, the patient again came to see me. The softening had diminished considerably and had disappeared completely from the vaginal portion. The uterus had diminished somewhat in size and there was distinct fluctuation. I now made a positive diagnosis of pregnancy with a dead fetus. There were still no symptoms. On the 30th of January, 1896, the ovum was expelled spontaneously. It consisted of a greatly mummified fetus, about 14 cm. in length, and the placenta.

As compared with these positive signs the symptomatology is no longer of importance, although certain statements on the part of the patient may arouse the suspicion of fetal death. These are a bad taste in the mouth, loss of appetite, increasing lassitude, general ill health, the sensation of a foreign body rolling about in the abdomen, chilly feelings and the like. Some of these symptoms are complained of when the fetus is living, particularly if there have been long-continued hemorrhages. Hemorrhage during pregnancy is by no means a sign of fetal death; it occurs much oftener with a living fetus, while, on the other hand, it may be absent when the child is viable.

Diagnosis of Fetal Death from the Symptoms.

Diagnosis of Abortion.

The first suspicion of abortion is usually aroused by hemorrhage requiring medical aid, either during an undoubted pregnancy or when pregnancy has not been suspected. The first question that must be answered in these cases is:

Has an abortion taken place? The diagnosis of abortion is easier if it is known, either from previous examinations or from definite statements on the part of the patient, that pregnancy exists. In a pregnant woman certain symptoms at once point to abortion, particularly a certain kind of hemorrhage. Abundant hemorrhage, or the discharge of recent venous or arterial blood, is due to recent separation of the ovum during abortion; whereas the blood is brownish or brownish-yellow, or mixed with mucus, when there is endometritis or some disease of the ovum, and the blood has been retained for some time in the uterus. The diagnosis of abortion is still more probable when a pregnant woman has had labor pains. The feeble uterine contractions which accompany abortion during the early months are not always recognized by the woman as labor pains, especially if she is a primipara; but they reveal their true character to the physician by their rhythmical, "jerky" occurrence, the dragging pains in the sacrum,

Diagnosis from the Symptoms.

abdomen, and intestines, the downward pressure on the bladder and rectum, and the hemorrhage, which completes the picture. It is true that even labor pains are not always a sign of immediately impending abortion, as they may be present for some time in certain disturbances, especially in endometritis, without interrupting pregnancy; when, however, they are associated with hemorrhage they usually usher in an abortion.

By combined examination it can be determined positively whether an abortion is in progress. If, instead of the uniformly soft uterus, a distinct hardening of its walls is felt, it should be regarded as the objective proof of labor pains. During abortion the consistency of the uterus often becomes uniformly hard and the tension of the walls is increased, so that it may appear harder than a non-pregnant organ, while at the same time differing decidedly from the soft gravid uterus. The changes in the cervix and in the ovum which are produced by the labor pains are the most valuable signs, but they do not include dilatation of the external os and lower segment of the cervix, which are among the most frequent phenomena observed in multiparæ. If, however, the upper portion of the cervix or even the internal os is dilated or admits a finger, it is a positive sign that labor pains are about to expel the ovum, or that the ovum has just been expelled. Dilatation of the cervix is the most reliable sign of abortion in pregnant women; the phenomenon may occasionally disappear temporarily, but abortion is nevertheless bound to occur sooner or later. If the finger is introduced into the uterus, the ovum is felt immediately above the internal os, or even occupying the cervix itself.

Diagnosis Based on the Obstetrical Changes.

The simplest way to make a diagnosis of abortion is by the fetal parts, whether they have been expelled spontaneously and delivered to the physician for examination, or are expelled during examination, or positively recognized as such within the uterus. A careful examination must be made of everything that is expelled from the uterus, as the findings of a minute portion of the ovum may suffice to establish an otherwise difficult diagnosis. (The anatomical examination of fetal parts will be discussed later.) It is needless to say that recognition of fetal parts is most difficult if the examiner is restricted to palpating them within the uterus. (For the findings within the uterus during the various stages of abortion, see page 141.) The remains of an abortion can always be distinguished from polypi and malignant disease not only by their peculiar shape and consistency, but chiefly by the fact that they are always easily separated from the uterine wall. The interpretation of the palpatory findings is more difficult, however, when the fetus is dead and has been retained for some time in the uterus, because the ova are round and hard and

Diagnosis Based on the Fetal Parts.

for that reason easily mistaken for submucous myomata or sarcomata. They differ from these, however, by the fact that they can easily be crushed, and particularly, as has been stated, by the ease with which they can be separated from the uterine wall.

The diagnosis of abortion is much more difficult in the absence of positive proof of pregnancy. Under these circumstances, an attempt should first be made to establish this point, because it gives the correct interpretation of all the previously described symptoms and objective signs. Unfortunately, the diagnosis encounters great difficulties because with the beginning of abortion the softening of the vagina and vaginal portion becomes much less, particularly if hemorrhages have been present for some time; the uterus itself during abortion is considerably smaller on account of the persistent tension of the muscle and the labor pains, the characteristic softening also is absent. These difficulties in the way of a diagnosis of abortion are especially marked in the second month because, owing to the changes that have just been described, the uterus closely resembles a non-gravid organ, whereas during the third and fourth months it is considerably larger, and usually also somewhat softer than a non-gravid uterus. In these cases Hegar's sign is very valuable. The history is often of little use in these cases because regular and irregular hemorrhages during pregnancies that end in abortion must occur so early that the amenorrhea of pregnancy either cannot be demonstrated at all, or menstruation merely appears to have been delayed a few days beyond the normal period. Amenorrhea, nevertheless, if positively demonstrated, is an important element in the diagnosis. The diagnosis of abortion is not difficult if the cervix is patulous and the ovum can be felt.

Once the diagnosis of abortion has been positively established, a second question must be answered because it is of prime importance in the treatment of the case. This question is:

In what stage is the abortion? Abortion begins with the first changes in the genitalia, which do not subside again, and ends with the expulsion of the last fetal part. As a rule, abortion is a protracted process and may extend over many weeks and months. (The longest abortion, in my own observation, lasted thirty-two weeks.) As the physician's aid may be demanded at any moment during this period, obviously, abortion in a great variety of stages is encountered. For practical purposes we distinguish three stages which, however, merge imperceptibly one into the other:

Diagnosis of the Stage of Abortion.

1. Threatened abortion.
2. Beginning abortion with intact ovum.
3. Incomplete abortion (retention of fetal parts).
4. Complete abortion.

The diagnosis of these conditions is made most easily and with the least amount of danger to the patient by the fetal parts that have been expelled; hence the physician should first ask to see the discharged materials in every case of abortion and attempt to build up the ovum from the individual pieces in the same attitude which it occupied in the uterus. If all the parts are obtained, both fetal and maternal, abortion is complete, and no further examination of the patient is necessary; even if a few pieces of decidua are wanting, it is not necessary to explore the uterus for diagnostic purposes because their presence usually has no influence one way or another on the subsequent course of the case. All the fetal parts must, however, be accounted for before the physician ventures to form an opinion in regard to the stage of the abortion with which he is dealing. The patient's statements on this point are of no value whatever, because large portions of the ovum, or even the entire fetus, may be expelled unobserved during the third and fourth months. For this reason it is not safe to base a diagnosis of threatened abortion or intact ovum on the patient's statement that no part of the ovum has been expelled. The information that "pieces have come away" may refer either to fetal parts or to pieces of coagulated blood, and a reliable diagnosis of abortion can rarely be made in this manner; nor is it possible to determine the stage of the abortion from the symptoms.

Threatened abortion may be assumed if the hemorrhage is scanty, if it occurs at long intervals, if the fluid is largely mixed with mucus and contains very little fresh blood. An abundant flow of blood, particularly if the blood is fresh, whether arterial or venous, points to extensive separation of the ovum, and is practically a certain sign that abortion is in progress. If portions of the ovum are expelled, or the contents of the amniotic sac have been evacuated, the uterus contracts and the hemorrhage may cease, although large masses are still retained within the uterus. Renewed hemorrhages in such a case indicate that other masses have become detached. A profuse hemorrhage always points to retention, and as a rule the size of the retained portion is in proportion to the abundance of the hemorrhage. When abortion is complete, the hemorrhage is permanently arrested. The behavior of the labor pains also has some value for the diagnosis of the stage of the abortion. As a rule their severity is in proportion to the size of the fetus; hence if the uterine contractions are distinctly painful, the presence of an intact ovum, or the retention of large masses, may be assumed. As soon as the uterus is empty, the labor pains cease; on the other hand, however, the absence of labor pains from time to time during the course of an abortion does not indicate that the process is completed.

It is not difficult to decide what stage of abortion one has to deal with if the cervix is patulous and admits one finger, as the condition of the ovum within the uterus can then be determined by palpation.

Diagnosis when the Cervix is Dilated.

If the ovum is still completely intact, it is felt in the second month in the uterine cavity and may be recognized by its spherical shape and polypoid attachment, whereas all the rest of the uterine wall is smooth; or the ovum may be descending, and in that case is also felt as a round body lying on the internal os, or in the cervix. In the third month the amniotic sac, usually quite flaccid, is felt; or fetal membranes and the fetal parts behind them; or, after evacuation of the amniotic fluid, the fetus itself may readily be recognized. In the fourth month these conditions are still more easy to interpret. Intact blood-moles are characterized by very thick fetal membranes and almost give the impression of placental tissue. The findings in a case of incomplete abortion are quite different. During the second month the amniotic sac ruptures, or the ovum with its chorionic villi separates from the decidua; the remaining parts of the ovum collapse and form a polypoid body within the uterus or extend into the cervix, presenting a very irregular surface and friable consistency. If nothing but separated decidual tissue remains behind, it is found hanging within the uterus in loose shreds. Small particles of chorion and decidua reflexa produce merely a mortar-like roughness at the site of implantation. During the third and fourth months the placenta is often retained after expulsion of the fetus. A completely adherent placenta often escapes the sense of touch because the fetal surface, which presents toward the uterine cavity, is smooth like the uterine wall itself; but on more careful examination large vessels are occasionally felt on the surface of the placenta, or it is noticed that one uterine wall is thickened from the presence of a soft deposit; as soon as a part of the placenta separates, the diagnosis becomes easy. Pieces of the placenta take on the shape of the uterine cavity, which they completely fill, or else they protrude into the cervix. If abortion is complete, the cervix usually closes in a short time; within the uterine cavity the wall everywhere feels smooth, except for a slight roughness at the site of implantation.

If the cervical canal is closed, as is often the case in protracted abortion, direct palpation of the ovum is impossible, as dilatation of the cervix for diagnostic purposes only is not permissible unless there

Diagnosis when the Cervix is Closed.

is reason to suspect the presence of large masses that must be removed at once. In such a case the diagnosis of the stage of the abortion must be made solely by the condition of the uterus itself. The shape and size of the uterus, and the degree of softening, are the only signs at our disposal for arriving at a diagnosis, which is often exceedingly difficult, so that even the most experienced

examiner is often mistaken in his diagnosis of the contents. The presence of an intact ovum may be surmised if the size of the uterus corresponds approximately to the calculated period of pregnancy, and the organ is soft to the touch. (It must be remembered, however, that these signs are not present when there is a dead, intact fetus.) Distinctly palpable labor pains are usually in favor of an intact ovum or the retention of large masses. If the fetus or part of the ovum has been expelled, the uterus contracts more firmly and loses its softness, particularly if there has been a severe or protracted hemorrhage. The softness and discoloration of the vaginal portion and the vagina also subside; hence, if the uterus is distinctly smaller than it ought to be for the duration of the pregnancy, and at the same time harder, retention may be assumed. It is obvious that a diagnosis between retention and an intact ovum must be very difficult in the second month, because the difference in the size before and after the expulsion of the ovum is so slight; and it is also obvious that the difficulties are practically insurmountable if the ovum is dead. The diagnosis becomes increasingly easier the later abortion occurs during pregnancy, because the uterus in that case is much smaller and becomes flattened after the fetus has been expelled; on the other hand, it also retains a considerable degree of softening for some time. Complete abortion may be assumed if the uterus has practically returned to its normal size, if it feels hard, and the bleeding has ceased.

Diagnosis of Retained Portions.

The diagnosis of retention alone should not satisfy the physician, and he should determine, if possible, the character of the retained portions; for it is of great importance in the treatment of abortion to know whether the uterus still contains the entire placenta or only parts of the placenta, or the chorion, or whether only decidual tissue with insignificant parts of the chorion are retained. This point also can only be decided by the size of the uterus and the degree of softening. If it is borne in mind that the size of the uterus during the early months is due more to the thickness of its walls than to its contents, it will be readily understood that owing to the individual thickness of the wall the uterus may seem to be very thick, although the retained masses are quite small; and, on the other hand, a uterus of normal size with thin walls may contain an ovum almost as large as a walnut. The diagnosis of the contents from the degree of softening is subject to the same difficulties, because the softening depends on the vascularity, which differs in individual cases. It may be quite marked in the retention of decidual tissue and, on the other hand, altogether absent when large masses are retained, particularly if the woman has had hemorrhages for some time. It is extraordinarily difficult to decide whether decidual tissue or large portions of the fetus are retained in the uterine cavity, and mistakes are

quite as common as correct diagnostications. One must be guided by the general principle that the larger and softer the uterus, the greater the probability that it contains fetal parts. During the third and fourth months the entire placenta is retained within the uterus in most cases. The uterus remains large and very soft, and shows a certain similarity to a gravid uterus, except that it is more flattened. If the placenta has been retained for some time, the uterus becomes smaller and harder, until finally, after months of retention, the increase in size may no longer be noticeable.

For the general practitioner the diagnosis of the different stages of abortion resolves itself into the question whether there is threatened abortion, which in the particular case may be arrested, or whether the abortion is inevitable. This question is easily answered if fetal parts are expelled; if any part of the ovum or no more than a piece of decidual tissue has escaped from the uterus, abortion is certain to occur. It may be expected also with a very great degree of probability if in the course of its progress the internal os begins to dilate, and still more, if the amniotic sac enters the internal os; although the labor pains may subside temporarily, there is practically no hope that pregnancy will go on to its normal termination. Diagnostic difficulties arise when the cervix is closed and the abortion is ushered in by hemorrhages and labor pains. In such a case one's judgment must be based on the character of the hemorrhage under labor pains. A brief hemorrhage, particularly if it follows a traumatism, permits a more favorable prognosis than a long-continued bleeding, even if the quantity lost is slight, because the latter points to disease of the fetal membranes or endometritis, which usually leads to abortion. Profuse hemorrhage almost always indicates inevitable abortion because it is due to separation of the ovum. Labor pains may occur in pregnancy, and are quite likely to disappear again. But if they become more frequent and more painful, and particularly if they can be demonstrated objectively, there is great danger of abortion. Occasionally they may disappear with suitable treatment, but their cessation in many cases is merely temporary.

Can the Abortion be Arrested?

If the diagnosis of a dead fetus has already been made, abortion is inevitable and no attempt should be made to prevent it.

The uterine sound has but a limited application in the diagnosis of retention products, because soft, polypoid oval masses cannot be recognized with certainty with the sound, and further, if the uterus contains large masses of tissue, the introduction of the sound is frequently productive of severe hemorrhage. For this reason the sound should not be employed when the uterus is large and soft. On the other hand, the sound is of great value

Diagnosis with the Sound.

for the recognition of retained parts of decidua or small pieces of chorion, and for this reason it is most frequently employed for the diagnosis of abortion in the second month. If marked irregularities are discovered at the fundus, and the procedure is attended with increased hemorrhage, abortion may be suspected, even if the uterus is not enlarged or softened. Before the diagnosis of abortion is complete, it must be determined by examination whether the abortion is recent or the parts are in a state of putrid decomposition. In cases of protracted abortion one must never neglect to take the temperature and investigate the odor for possible indications of decomposition.

Diagnosis of a Putrid Abortion.

Finally, the diagnosis of abortion must be followed by an attempt, by means of a careful macroscopic and, if necessary, microscopic examination of the fetus, placenta, and especially the fetal membranes, to determine the causes of the abortion, especially if the history or the occurrence of repeated abortion points to some disease of the fetal membranes.

Diagnosis of Extra-uterine Pregnancy.

Definition. The term extra-uterine pregnancy is applied to every condition in which the impregnated ovum is implanted outside of the uterine cavity. Implantation may occur anywhere along the course of the tube, from the uterine orifice to the infundibulum or even on the fimbria ovarica; or in the ovary, whether it be normal or in direct communication with a dilated tube. Primary implantation of the ovum on the peritoneum has not as yet been positively demonstrated.

Definition.

According to the site of implantation we accordingly distinguish: Tubo-uterine or interstitial; tubal (graviditas isthmica, ampullaris, fimbriæ ovaricæ); tubo-ovarian; ovarian; and abdominal pregnancy or gestation.

Classification.

Abdominal gestation is subdivided into primary, when the ovum is primarily implanted on the peritoneum; and secondary, when an ovum primarily implanted in the tube or ovary leaves these organs and continues its subsequent development on the peritoneum (Fig. 77).

From the clinical standpoint we must include pregnancy in the rudimentary horn of the uterus among the varieties of extra-uterine or ectopic gestation, because it produces the same symptoms and usually cannot be differentiated clinically.

The above subdivision of extra-uterine pregnancy is based on anatomical investigation and cannot be carried out clinically except in the rarest cases. Tubal pregnancy is by far the most frequent variety and must be regarded as the type of extra-uterine gestation. The diagnosis of this variety will therefore occupy our attention chiefly, and I shall

merely add as an appendix a few remarks about certain points which in favorable cases may render the diagnosis of the rarer varieties possible.

The methods which we select for arriving at a diagnosis must be somewhat restricted in extra-uterine pregnancy, or at least must be employed with extreme caution, because the extra-uterine gestation sac is a structure that is very easily injured. Moderately severe pressure, or an attempt to displace it, may cause rupture and produce death from internal hemorrhage. It should therefore be an absolute rule to palpate with extreme caution and to employ very light pressure in every case in which there is a possibility of extra-uterine pregnancy; and especially under anesthesia, when the woman cannot defend herself by expressions

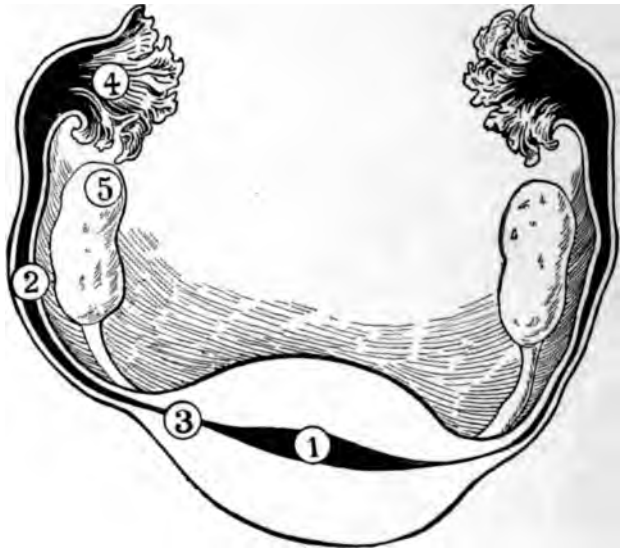

FIG. 77.—SHOWING IMPLANTATION OF OVUM IN THE DIFFERENT VARIETIES OF PREGNANCY (after Bumm). 1, uterine; 2, tubal; 3, interstitial pregnancy; 4, implantation in the fimbriæ; 5, ovarian pregnancy.

of pain, excessive pressure must be carefully avoided. Every patient with extra-uterine pregnancy must be kept under observation for signs of internal hemorrhage after the examination has been completed. The use of the sound should be avoided altogether, because the displacement of the uterus and adnexa which it necessitates may cause rupture of the gestation sac or necrosis of an existing hematocele. For the same reason digital exploration of the uterus and exploratory curettage are positively contraindicated.

The diagnostic picture of extra-uterine pregnancy varies greatly, depending on the time when the patient is seen and the various terminations which result from interruption of the fetal development. Hence a subdivision based on these points is desirable, as it materially simplifies the diagnostic problem. As in the case of intra-uterine gesta-

tion, a division of the diagnosis into the two halves of pregnancy is useful, so also in extra-uterine pregnancy the same plan is followed because the principles which underlie the diagnosis are entirely distinct during these two periods. During the first four or five months the diagnosis is based on the changes seen in the maternal genitalia; during the second half of pregnancy, on the demonstration of the presence of a fetus.

The **diagnosis during the first half of extra-uterine pregnancy** is based on the demonstration of changes which it produces in the maternal genitalia, *i.e.*, on palpation of the gestation sac and the changes which occur in it as a result of the interrupted development of the ovum, and on the accompanying changes in the other genital organs, especially the uterus and vagina. The great majority of cases of extra-uterine pregnancy are not seen by the physician until disturbances have occurred, and if the ovum continues to develop without symptoms, it is not discovered until the patient desires from the physician a diagnosis of pregnancy or some other disease; hence the physician very rarely has the opportunity of diagnosing a uterine pregnancy in a natural process of development. Such a diagnosis would be a mere accident, while the diagnosis of an interrupted extra-uterine pregnancy is exceedingly common and of extraordinary importance.

Diagnosis in the First Half of Extra-uterine Pregnancy.

The diagnosis of symptomless extra-uterine pregnancy is for obvious reasons possible only during the first months because disturbances of various kinds usually appear early. It is based on the demonstration of a spherical or spindle-shaped swelling, which is sharply outlined, sometimes angulated, and forms a distinct contrast to the healthy, unchanged portion of the tube. The gestation-sac corresponds in size to that of the ovum because the thin wall of the tube does not increase the volume. It feels soft and doughy, but does not exhibit true tension or genuine fluctuation. It is not resilient but rather yielding, and differs in that respect from ovarian tumors and hydrosalpinx. The gestation-sac is quite movable unless it is attached to the surrounding structures by adhesions, in which case it soon loses its characteristic shape. In rare cases it is not pedunculated and grows between the two layers of the broad ligament. In such instances its connection with the tube is obscured, the shape is more spherical, and the wall becomes thicker because the broad ligament takes part in the hypertrophy incident to gestation. The uterus and vagina share in the palpatory findings, and also exhibit softening and hypertrophy (see page 153).

Undisturbed Extra-uterine Pregnancy.

Unusual symptoms in the course of extra-uterine pregnancy are usually the cause of an examination being desired. They may be from

peritoneal irritation, from rupture of the gestation-sac, or from threatened or actual expulsion of the ovum from the tube. In these cases medical aid is sought on account of sudden collapse, the sudden occurrence or periodical repetition of abdominal cramps, persistent hemorrhage, or on account of slight peritonitic signs or pressure symptoms. These symptoms therefore form the starting point of the diagnosis. The basic cause of these phenomena is the hemorrhage from the gestation-sac, which may, however, lead to a variety of different sequelæ:

Disturbed Extra-uterine Pregnancy.

1. Free internal hemorrhage. The general impression which these patients make on the physician is such as to leave no doubt in his mind that they are suffering from severe hemorrhage: apathy, pallor, small weak pulse in the severest cases, yawning and perspiration, at once suggest such a diagnosis. As external hemorrhage is absent, or very slight, the suspicion of internal bleeding is justified. Abdominal symptoms, vomiting, belching, and especially violent pain, at once direct attention to the abdomen. External examination reveals a slight distention and extreme sensitiveness to pressure, especially in the hypogastric region. If the loss of blood amounts to more than one or two litres, the free blood can usually be demonstrated by percussion in the lumbar region, and the resistance in this region is increased. Fluctuation is not present. While, therefore, the diagnosis of internal hemorrhage is usually positive, the source of the blood is not so easy to determine. Often dulness and increased resistance and sensitiveness to pressure in the hypogastric region direct attention to the genital organs. Internal examination, which must never be neglected in a woman in this condition, but must be performed with extreme caution on account of the danger of renewed hemorrhage, reveals a soft yielding resistance in Douglas' space, with slight anteposition of the uterus, or increased resistance in the region of the adnexa. Still the diagnosis of ruptured extra-uterine pregnancy is only provisional, albeit extremely probable, because examination of the adnexa in this condition is impossible, or the changes are so slight that they cannot be demonstrated. In many cases the cessation of menstruation indicates the direction which the investigation should take; but as irregularities of menstruation are by no means rare, and as a tubal pregnancy may rupture before menstruation has ceased, this diagnostic aid is by no means always available. Nevertheless, if the existence of internal hemorrhage has been demonstrated, tubal pregnancy is by far the most probable diagnosis. The difficulties are diminished if the internal hemorrhage has not occurred unexpectedly but in the course of an extra-uterine pregnancy already under observation or has been preceded by pain on the diseased side. The patient's statement

Free Internal Hemorrhage into the Abdominal Cavity.

that she felt an acute pain—"as if something had given way"—simultaneously with the beginning of the hemorrhage, may also help to suggest the correct diagnosis.

2. Encapsulated hemorrhage. Rupture of a pregnant tube, or tubal abortion, more frequently leads to hemorrhage into the gestation-sac, into Douglas' space, the region surrounding the tube, or the connective tissue of the broad ligament, than to free hemorrhage. As the blood coagulates, a distinctly palpable tumor is formed which, depending on its location, gives rise to a variety of physical signs.

Encapsulated Hemorrhage.

(a) If the hemorrhage takes place into the tube, either into the ovum or into the free cavity, palpation of the thus altered gestation-

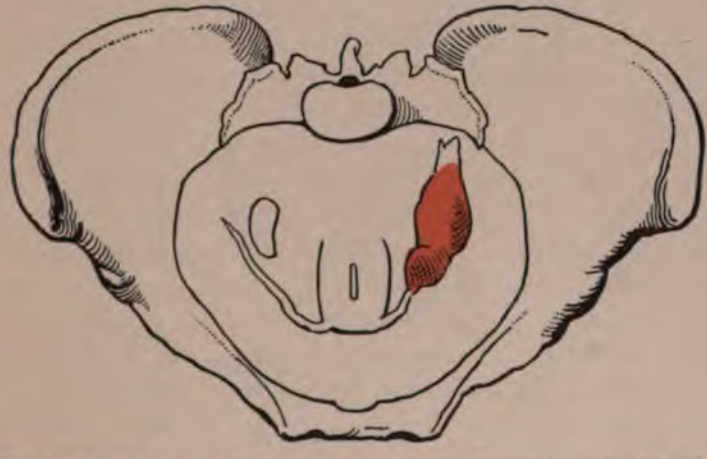

FIG. 78.—LEFT-SIDED TUBAL MOLE (without hematocele-formation). P.-F. ⅕. (Original.) The uterine segment of the tube is free, also the abdominal; in the middle, between the two, is the hard, tortuous portion of the gravid tube distended with blood.

sac is much more easy than in the case of an undisturbed pregnancy. The tube is distended by the blood, and its shape and tortuosity can be readily recognized. The uterine portion of the tube is frequently free from blood, and its normal thickness and soft consistency contrast sharply with the portion which is filled with blood (Fig. 78). The consistency of the tube is very hard and firm, and the tube is almost painless on pressure. Adhesions are frequently absent, hence these tubal tumors have a certain degree of mobility. The position of the tumor usually corresponds accurately to the normal position of the tube.

(a) Hemorrhages into the Tube.

(b) If the blood escapes rapidly in large quantities from the ruptured or aborting tube, it usually collects in Douglas' space, and the abdominal extremity of the tube is situated in its upper portion and there becomes encapsulated. A retro-uterine hematocele is formed, representing a

tumor which usually occupies the whole of Douglas' space and forces the posterior vaginal vault downward. The uterus is in anteposition and, if the mass of blood is very large, in an elevated position. The size of the tumor depends on the quantity of the effused blood, and this in turn determines the degree of displacement of the neighboring organs. In the case of excessive hemorrhages the blood also collects above the uterus, reaches to the anterior abdominal wall, and produces large masses having extensive connections with

b) Retro-uterine Hematocele.

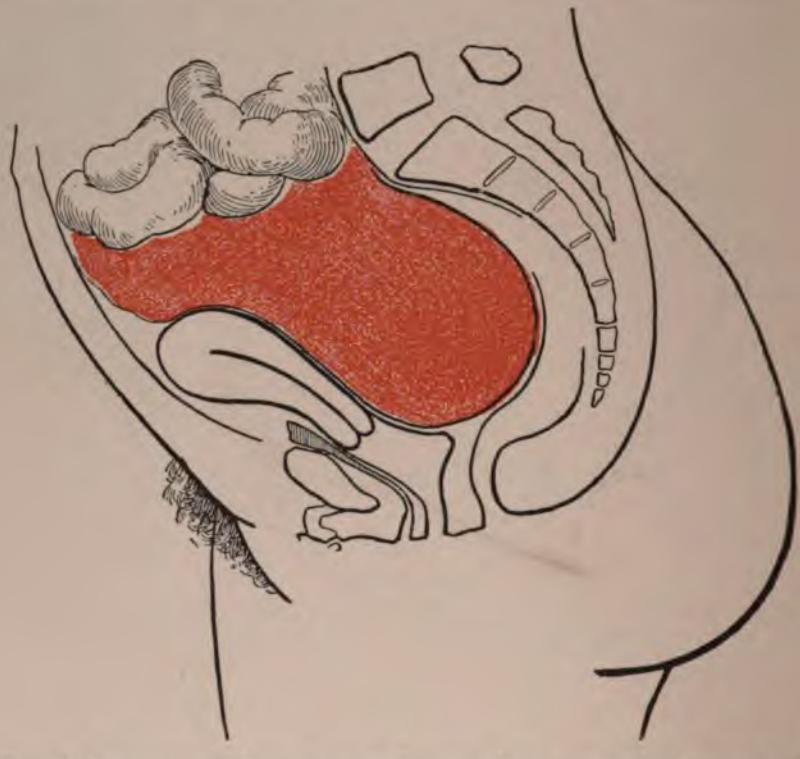

FIG. 79.—RETRO-UTERINE HEMATOCELE IN RUPTURED LEFT-SIDED TUBAL PREGNANCY. P.-F. ⅓. (Original.) The hematoma extends beyond the uterus to the anterior abdominal wall, its irregular upper border being formed by coils of intestine which form its roof.

the abdominal wall (Fig. 79). The rectum is displaced to the left and backward, and narrowed so that it forms a cleft, but never deflected in the form of a loop in cases of pure intraperitoneal hematocele. The roof of the hematocele is formed by intestinal coils which are matted together in various places and render the upper outline of the hematocele, particularly if it is recent, very irregular. In older hematomata the inflammatory phenomena subside, and the upper boundary may become sharply defined, as in the case of an ovarian tumor (Fig. 80). The connection of the hematoma with the neighboring organs is, of course, very intimate, because the blood comes in direct contact with these

organs and undergoes coagulation. The firmest connection occurs at the posterior uterine wall; while the lateral wall of the pelvis, especially when the hematocele is small, is not always reached, so that the palpating finger enters between it and the tumor. As a result, these tumors present a moderate degree of mobility with the uterus, and this may easily lead to error in the diagnosis. The consistency is an important factor in the diagnosis of an intraperitoneal effusion of blood. Recent hematoceles are usually soft and flabby, like flaccid cysts, but may

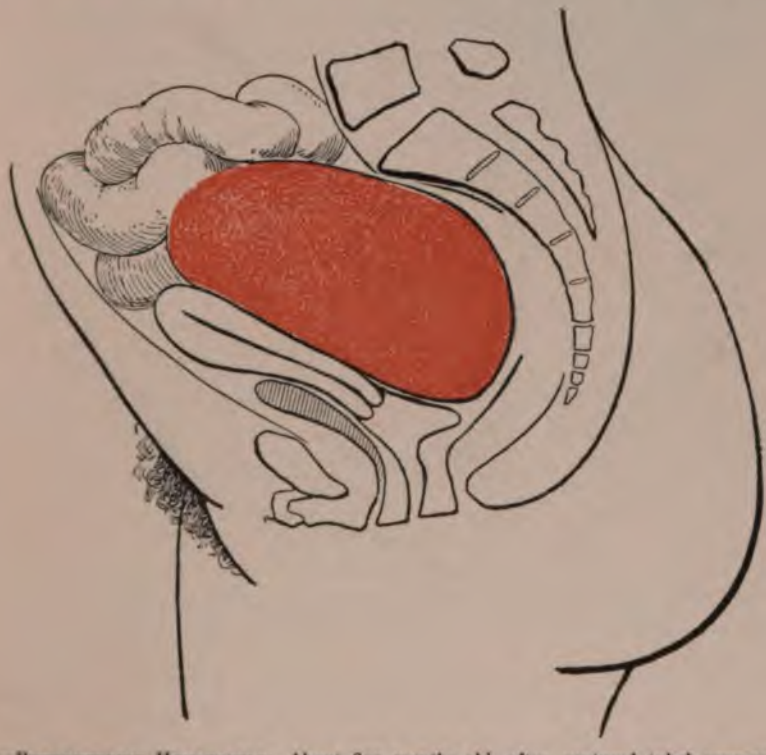

FIG. 80.—RETROUTERINE HEMATOCELE: About five months old, after ruptured tubal pregnancy. P.-F. ⅕. (Original.) The upper outline of the hematocele is sharply defined, owing to encapsulation.

become tense in a few hours; fluctuation is undoubtedly demonstrable in most cases. The blood soon coagulates and acquires a semisolid consistency, so that quite often differences between the fluid and more resistant parts may be recognized. As the inspissation of the blood continues and the fluid constituents are absorbed, the hard consistency of the zone of reaction becomes more and more distinct, and the characteristic feel of a hematocele is lost. The rapid transition from the cystic to a firm consistency is absolutely pathognomonic of hematocele. Only in exceptional cases the blood remains fluid for months and the consistency is that of a uniformly cystic tumor. The topography of the hematocele is more irregular when its position is lateral, when part

of Douglas' space was previously obliterated, or hemorrhage into the lateral portion of Douglas' space has been followed by encapsulation. In this case the tumor occupies a lateral position at the posterior surface of the uterus, forces only part of Douglas' space downward and forward, and displaces the uterus to the other side.

(c) If the blood escapes more slowly from the tube and in small quantities, or in successive hemorrhages, it coagulates at the fimbriæ or at the site of rupture, and forms a peritubal hematocele (Fig. 81).

(c) Peritubal Hematocele.

The position of these blood tumors is extremely variable and depends in the main on the position of the fimbriæ. As a rule they are to one side and behind the uterus, or they may extend below the level of the uterus and a little to one side; but quite frequently

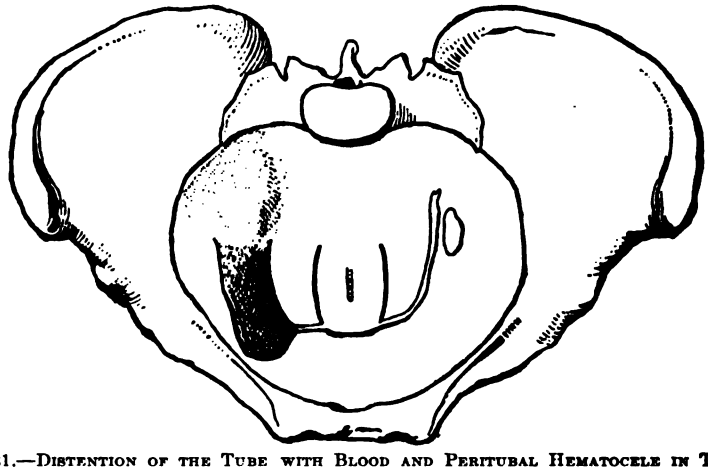

FIG. 81.—DISTENTION OF THE TUBE WITH BLOOD AND PERITUBAL HEMATOCELE IN TUBAL PREGNANCY. P.-F. ½. (Original.) The uterine segment of the tube is free; next comes the part distended with blood, and the abdominal extremity is surrounded by a small effusion of blood.

the tumor is found at the level of the pelvic inlet or even higher up. If the uterus is retroverted, the fimbriæ occupy the anterior half of the pelvis, and a blood tumor is formed in front of the uterus. The size of a peritubal hematocele depends on the quantity of the effused blood. Its shape is at first always indistinct, quite irregular in outline, with outrunners in various directions, producing quite bizarre forms such as are rarely seen in other conditions. After it has existed for some time, however, and particularly if the peripheral layer undergoes organization, the tumor becomes more distinct and like an ovarian tumor. The attachment of the hematocele to the neighboring organs —uterus, rectum, or pelvic wall—is usually so intimate that it has a large surface of contact. For this reason, it is at first immovable, but may gradually develop a considerable coincident mobility with the uterus and tube, particularly if the fibrinous attachment with the pelvis disappears. The consistency of a peritubal hematocele is at first soft

and yielding; later it becomes firm, but never decidedly hard. The rapid transition from a cystic to a firm consistency may often be observed in this variety. Occasionally the blood remains fluid for some time, and in this way an old hematocele with an organized cortical layer may form a tumor which, even macroscopically, is sometimes indistinguishable from an ovarian cyst.

(d) If the rupture of the tube is intraligamentary, the blood escapes between the two layers of the ligament and produces a so-called hematoma of the broad ligament. If the hemorrhage is slight, a tumor is formed alongside of the uterus with a broad attachment to its lateral aspect, and during its subsequent growth crowds the uterus over to the opposite pelvic wall. If the hemorrhage is profuse, the blood

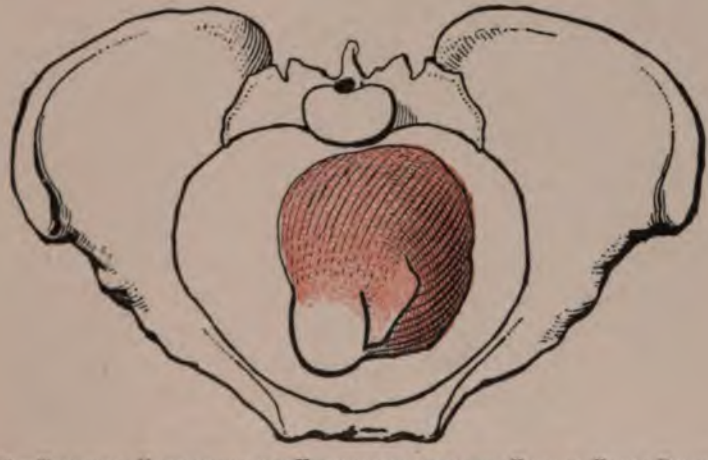

FIG. 82.—PERITUBAL HEMATOCELE AND HEMORRHAGES INTO THE TUBE IN TUBAL PREGNANCY. P.-F. (Original.) The uterine segment of the tube is but slightly thickened. It is joined by the portion of the tube which is distended with blood, and which on the outer side dips into a large hematocele that has formed around the fimbriated extremity.

burrows a path for itself underneath the peritoneum of Douglas' space to the iliac bone, around the cervix to the opposite side of the pelvis, and may eventually descend between the vagina and the rectum, surrounding both organs as far down as the perineum. Accordingly the shape of these tumors is exceedingly variable, although it is characterized by numerous outrunners, such as are seen in no other conditions except parametritic exudates. The consistency is usually hard because the blood infiltrates the connective tissue and rapidly coagulates. The connection with all the pelvic organs that lie in the path of the escaping blood is quite intimate.

(d) Hematoma of the Broad Ligament.

In most cases hemorrhages into the tube are combined with extratubal hemorrhages, giving rise to palpatory signs which make it possible to separate the hard, tortuous tube, distended with blood, from the partially coagulated hematoma. In peritubal hematocele one is espe-

cially apt to find, in the lateral and posterior portions of the pelvis, soft tumors presenting the above described peculiarities, and containing the extremity of the Fallopian tube distended with blood (Fig. 82). As the successive hemorrhages from the tube often occur at long intervals—weeks in some instances—different layers can sometimes be distinguished in the hematoma which correspond in hardness to the different ages of the successive hemorrhages.

In the objective examination of all these tumors we first attempt to demonstrate the presence of a hematoma by the shape, position, consistency, and connection with neighboring organs. This being established, it becomes probable that the hematoma is due to a tubal pregnancy because other causes, if the hematocele is intraperitoneal, are extremely rare. In a certain number of cases the probability is increased if the tube distended with blood can be felt merging with the hematoma. Nevertheless, the number of cases in which we can recognize an extra-uterine pregnancy by the objective examination and the tumor alone, will never be very large. In the majority of cases, we may be able to demonstrate a hematoma, in others the tumor does not even show the peculiarities of a hematoma with absolute certainty, and the diagnosis of tubal pregnancy therefore remains uncertain, because in all cases of suspected tubal pregnancy the examination must be made with extreme caution in order to avoid rupturing the tumor.

For this reason it is fortunate that we possess other objective signs of pregnancy which may assist in the correct interpretation of the otherwise doubtful abdominal tumor. These objective signs are:

Objective Signs of Pregnancy in the Genitalia.

1. Signs of pregnancy in the genitalia (see page 127, *et seq.*). Softening of the vagina, vaginal portion, and uterus, and increase in the size of the uterus, do not, it is true, occur as regularly in tubal pregnancy as in intra-uterine gestation. When the interruption to pregnancy occurs early, or the fetus is dead, softening and increase in the size of the uterus are often entirely absent; on the other hand, if the fetus is living, these changes play an important rôle. As softening of the vaginal portion, bluish discoloration of the mucous membrane, and even pulsation of the vaginal arteries may also occur in all inflammatory conditions, the value of these signs must be judged with extreme caution during the first months of tubal pregnancy.

2. The discharge of the decidua plays a much more important part in the diagnosis of tubal pregnancy. Under the congestion incident to pregnancy, the endometrium is converted into a decidua and is expelled in at least two-thirds of the cases, attended usually with severe pains resembling those of labor. The decidua is usually cast off as two membranes, which correspond to the two

walls of the uterus; rarely in single pieces. This débris is not often given to the physician for examination, and he is forced to rely on the statements of the patient, who, as a rule, gives an accurate description of a fleshy mass or masses. The decidua, which is usually discharged in the form of a closed sac, has a triangular shape with three openings, corresponding to the two orifices of the tube and to the internal os. The outer surface is rough; the inner surface is usually furrowed and occasionally contains areas infiltrated with blood (Fig. 83). The recognition of the decidua presents no difficulties, but the question whether the suspected membrane is a decidua from a tubal pregnancy, an abortion, or menstruation is not always so easy to answer. Abortion can

FIG. 83.—DECIDUA IN EXTRA-UTERINE PREGNANCY. (Original.) *a*. Cast of the uterus, the uterine surface presenting outward. *b*. The decidua has been divided along the middle of the anterior wall and reflected on both sides.

be positively excluded if neither half of the membrane contains an ovum or an opening for its escape; the menstrual decidua is thinner and is usually expelled in separate pieces; the decidua of tubal pregnancy is the thickest of all. In many cases the question must be decided by the microscope. (See microscopic diagnosis of the membranes expelled from the uterus.) The discharge of decidua points to extra-uterine pregnancy if abortion and membranous dysmenorrhea can be excluded with certainty by the clinical course and the physical signs.

Among 83 cases from my own clinic a positive history of the discharge of decidua was obtained in 36, and in 7 additional cases it occurred while the patients were in the wards.

The fact that no decidua has been discharged is not against tubal pregnancy, because the membrane may remain behind in the uterus and by a process of involution be converted into normal endometrium;

or its escape from the uterus may not be noticed. The discharge of the decidua, therefore, has only a positive value. The decidua is never discharged unless the tubal pregnancy is interrupted; it is always preceded by death of the fetus, rupture of the tube, tubal abortion, or hemorrhage into the tube. As, however, rupture and hemorrhage are not always followed by death of the fetus, discharge of the decidua is by no means a positive sign that such an accident has occurred; but it always indicates a disturbance of some kind. The decidua is usually discharged a few hours or days after the beginning of the disturbance and the process is attended with protracted hemorrhage.

An attempt has been made to utilize the regular development of a decidua in extra-uterine pregnancy as a diagnostic factor. A number of authors propose that the uterine membrane be curetted out for the purpose of demonstrating the decidua by microscopic examination. Such a procedure, however, is not permissible, because it has not infrequently led to rupture of the ectopic sac, or to septic infection of the hematoma, with a fatal termination. But the most potent argument against the procedure is found in its unreliability; for during the early stage, when the demonstration of a decidua would be a particularly useful diagnostic point, the membrane is not always fully developed; or it is present only in spots, and the curette cannot be depended upon to bring any of it away; or it may have been already discharged without the patient's knowledge. Besides, the interpretation of the microscopic picture may be rendered difficult by retrogressive processes, or by the similarity of decidual tissue to other changes in the mucous membrane.

Changes in the Breasts.

3. The increased development and activity of the mammary glands which accompany pregnancy occasionally point to a diagnosis of extra-uterine pregnancy, more, however, in the positive than in the negative sense. Even the presence of colostrum in the glands can be utilized only in the case of primigravidæ, or when a considerable interval has elapsed since the last confinement, because the glands continue to exude secretion on pressure for a long time. As, however, a mammary secretion also occurs with inflammations and neoplasms of the internal genitalia, this sign must be utilized with great caution. After the death of the fetus a transformation of the colostrum into milk has occasionally been demonstrated.

Diagnosis from the Symptoms.

Even the above-mentioned changes incident to pregnancy do not always suffice to make it positive that an existing tumor is the product of extra-uterine pregnancy; quite often one is compelled to depend in part for the diagnosis on the history and symptomatology. The amenorrhea of pregnancy is almost regularly present, and entirely absent only in a very limited number of

cases. In most instances menstruation is at least delayed a few days before the first disturbances make their appearance. Rupture of the sac may, however, take place on or even before the day of the expected menstruation. Quite often menstruation occurs at the right time during extra-uterine pregnancy, but the quantity of blood discharged is diminished. Disturbances in the course of pregnancy, associated with hemorrhage, may be noted so early that they obscure the period of amenorrhea. For these reasons the patient's statements are not always to be depended upon; but any degree of amenorrhea, even if it lasts only a few days, may excite the suspicion of pregnancy.

Among 79 cases from my clinic, amenorrhea was present in 67; in 3 cases the periods returned during pregnancy; in 9 amenorrhea was not observed because of disturbing hemorrhages, which on 7 occasions occurred before the expected menstruation, and in 2 cases on the expected day of the flow.

Subjective symptoms of pregnancy, such as nausea and vomiting, are less frequent in extra-uterine than in intra-uterine pregnancy, and for that reason have less diagnostic value.

The history does not become typical until complications in the course of the extra-uterine pregnancy have made their appearance, such as tubal abortion, rupture of the ectopic sac, or death of the fetus. The symptoms consist in abdominal cramps of very abrupt onset, usually without any previous cause, but occasionally as the result of a traumatism of some kind (examination, lifting, dancing, and the like). These pains are described by the patient as lancinating pains, appearing suddenly in the abdomen or rectum, with syncope, vertigo, vomiting, and pallor. They are usually of short duration, but recur in a similar manner after a shorter or longer interval, several attacks being usually recognized in the course of the process. The pains are probably due to the hemorrhages that take place into the lumen of the tube or into the abdominal cavity.—The second symptom pointing to some disturbance in the course of extra-uterine pregnancy is external hemorrhage, which may continue uninterruptedly for a long time, even several months. The hemorrhage is moderately severe; the blood is often mixed with mucus, rarely with pieces of tissue; and the hemorrhage occurs immediately after the above-described cramps, or sometimes after an initial attack. The decidua is usually discharged during the first days of the hemorrhage. As the occurrence of these symptoms lends considerable diagnostic importance to the history, I shall relate a few typical cases.

Case 6. Mrs. S.; 41 years; married in her 21st year; seven confinements; no abortion; last confinement seven years ago. Never had any abdominal disease; last menstruation, December 24, 1893. On January 27, 1894, returning home after an evening of strenuous dancing, she was suddenly seized with severe tearing sensations in the rectum, vertigo, and

nausea; no syncope. The pain lasted from one-quarter to one-half hour, but was not repeated. The abdominal cramp was attended with uterine hemorrhage, which has continued for seven weeks. No discharge of membrane has been observed. Findings: Peritubal hematocele with hemorrhages into the tube.

CASE 7. Miss N.; 19 years. First menstruation at the age of 14 years; regular every four weeks; always profuse and attended with abdominal pain. Last menstruation occurred on August 1, 1894; on September 1st, slight hemorrhage; on September 10, a more severe hemorrhage lasting five days, after which it ceased and returned after a bath; it has now been going on for six weeks. The hemorrhage came on after the bath, and at the same time she was seized with abdominal pain, cramps in the abdomen, syncope, vertigo, and nausea. After two weeks she had a second attack, exactly like the first. Discharge of the decidua was not noticed. Findings: Retro-uterine hematocele with hemorrhage into the tube.

CASE 8. Mrs. W., aged 24 years; married four years; had one full-term child three years ago; since then she has been ill, the last menstruation occurring on the 4th of December. About the middle of January she was seized with severe pain in the abdomen, lasting one-quarter of an hour and not attended with hemorrhage; in the beginning of February she had another severe abdominal cramp, lasting about the same time, which was repeated several times on the same day. The second abdominal cramp was attended with hemorrhage, which has so far lasted seven weeks. A week after the beginning of the hemorrhage fleshy pieces were discharged without pain. The patient thought she was pregnant because of her abnormal appetite. Findings: Retro-uterine hematocele.

The physician's task is not complete when he has positively demonstrated the existence of extra-uterine pregnancy. Another question of at least equal importance remains to be answered, namely, the stage of development of the extra-uterine ovum. Its importance is due to the danger of hemorrhage which threatens the patient if the ovum continues to develop. So long as the fetus is alive, the mechanical conditions which tend to destroy the implantation-site of the ovum and those which cause arrosion of the tubal vessels continue and may unexpectedly precipitate the catastrophe of an internal hemorrhage. If, on the other hand, the connection between the ovum and the tube has been severed by its escape from that structure, the danger of further bleeding is obviated and the retrogressive processes begin. As a rule, the destructive processes occurring at the site of implantation are arrested also if the ovum is dead, even though it is still attached to the uterine wall; occasionally, however, the peripheral portions of the ovum continue to invade the tissues at the site of implantation and thus severe hemorrhages may be produced. Therefore, so long as the ovum remains in the tube, it cannot be said that the danger of hemorrhage has been entirely removed. It is, therefore, important that the diagnostician shall advise immediate operation in cases in which a severe internal hemorrhage is probable, or at least within the realm of possibility. Such cases are:

1. All cases with a living fetus.

2. All cases in which the ovum is positively known to be still in the tube and the process has not been arrested (tubal mole).

That immediate operation is indicated in the first group of cases is generally conceded, and in most of the cases of the second group active interference is also required; on the other hand, in an extra-uterine pregnancy in which the ovum has been expelled beyond the possibility of a doubt, no operation is usually performed; and in cases in which the expulsion of the ovum is not definitely established, the expectant plan of treatment is followed.

The diagnosis of a living fetus in the first half of pregnancy can be made only by positively demonstrating the presence of a gestation-sac which is still undergoing development. In the absence of disturbances of any kind in the course of pregnancy, it may be assumed that the development is progressing if it has the above-described, uniform tension, and corresponds in size to that of the ovum. The uterus at the same time is usually somewhat enlarged and soft, and the vaginal portion and vagina also exhibit softening and bluish discoloration.

Diagnosis of a Living Fetus.

A more difficult question to answer, after disturbances have made their appearance, is: which will be likely to interrupt the normal course of the pregnancy, and which are not necessarily followed by the death of the fetus?

Interruption of the pregnancy by destruction of the ovum may be assumed to have taken place with the greatest degree of probability if a severe internal hemorrhage occurs. Large hematoceles, completely filling the pelvis, also as a rule indicate death of the fetus, because such severe hemorrhages are due to extensive separation of the ovum; there are, however, exceptions to the rule. Small hematoceles often occur coincident with the development of the sac. It is not safe, therefore, to draw the inference that the ovum is alive from the size of the ectopic sac and the fact that it corresponds to the period of gestation. On the other hand, it may appear too large because of hemorrhages into it, or a soft hematocele may be mistaken for an ectopic sac, and a living fetus diagnosticated if it happens to correspond in size to the duration of pregnancy. Even if continued growth of the gestation-sac has positively been established by observation, it is not absolute proof that the ovum is still developing, because the growth may be due to hemorrhage.

The signs of softening in the genitalia are too inconstant and vary too much in individual cases to be of any value; but if it can be positively shown that such signs are subsiding, or if a previously observed pulsation in the vaginal arteries ceases, death of the fetus is extremely probable. The discharge of decidua is neither for nor against death of the fetus. Occasionally the occurrence of milk in the breasts, instead of previously demonstrated colostrum, may indicate interruption of the pregnancy and the beginning of the puerperal state. The pain which is characteristic of disturbances of development has no diagnostic

value, because the hemorrhage into the tube does not necessarily cause death of the fetus. Similarly, protracted uterine hemorrhage may occur whether the fetus is dead or alive, although in the latter case such hemorrhage is, it is true, extremely rare.

From my clinical material, I offer the following data as aids in the diagnosis of a living or a dead fetus:

In 4 cases in which the fetus was unquestionably alive enlargement and softening of the uterus were found in 2; softening and discoloration of the vaginal uterine membrane in 3; attacks of pain in 4; uterine hemorrhage (in one case lasting two and a half months) in 3.

In 73 cases in which the fetus was unquestionably dead, enlargement and softening of the uterus was found in 20; discoloration and softening of the vagina in 20; pulsation of the vaginal arteries in 8; discharge of decidua in 36; attacks of pain in 68; uterine hemorrhages in 67 (in 63 the hemorrhage was protracted); increase in the size of the tumor in 3; diminution in the size of the tumor in 33.

To illustrate the difficulties of making a diagnosis of a living fetus, I cite the following cases:

CASE 9. Mrs. S. Uterus enlarged and soft, displaced forward and to the left (sinistro-anteposition); vagina somewhat softened, slightly bluish. On the right, behind the uterus and at the level of the pelvic inlet, a tumor as large as the fist, merging with the tube; the abdominal half of the latter is thinned, while the uterine half appears to be approximately normal. The consistency of the tumor is tense and cystic; somewhat harder at the inferior pole. Pulsation of the vaginal arteries. History: Last menstruation January, 1894. On March 26th a moderate hemorrhage occurred and this has continued until now with some interruptions. No discharge of decidua; no cramps; no attacks of syncope. The nausea still continues. The attending physician has noticed a uniform increase in the size of the tumor until lately. Laparotomy showed no living fetus, but a peritubal hematocele and the tube distended with blood emptying into it.

CASE 10. Mrs. H. Introitus slightly bluish; vagina and vaginal portion somewhat soft (succulent); uterus large, not soft. To the left, and behind the uterus a round tumor the size of the fist, with broad adhesions with the left lateral aspect and posterior surface of the uterus; consistency distinctly fluctuating, with moderate tension; no blood-clots can be found within the tumor. The history shows that the last menstruation occurred December 18, 1893; since then a number of irregular hemorrhages of short duration; several attacks of syncope, but no distinct cramps. A diagnosis of tubal pregnancy with living fetus is made because the size of the sac corresponds to the period of pregnancy; because the tension is moderately elastic and the shape round; because the length of the uterus is 9 cm., and the vagina shows a marked degree of softening. Laparotomy showed hematocele.

CASE 11. Mrs. H. Last menstruation in beginning of August, 1897; on August 30th, first attack of pain, which during the subsequent course of the disease was followed by eight more, the last occurring on the 30th of October. Examination on the 31st of October revealed a cystic tumor as large as the fist to the right, and behind the somewhat enlarged uterus. The tumor was taken for a hematocele. A week later, however, I made a diagnosis of a living fetus because the tumor had increased somewhat in size, and particularly because the softening of the vaginal portion was distinctly increasing. Operation confirmed the diagnosis of a living fetus.

CASE 12. Mrs. A. Last menstruation in beginning of November, 1905, *i.e.*, two and a half months ago. Since then complete amenorrhea. Beginning, middle, and end of December, three attacks of severe abdominal pain resembling labor pains, which were chiefly localized on the right side. No attacks of syncope; no symptoms of anemia or peritonitis. Between the first and the second attack the patient was entirely free from symptoms; since the second attack she has had constantly slight pain in the right side and in the back, and sometimes nausea. During the past six weeks the breasts are said to have increased in size.

January 15, 1906, the following conditions were found: Vagina and vaginal portion somewhat softened; uterus in sinistro-anteposition, of normal size and hard; to the right and between the uterus an approximately oval tumor, a little larger than a goose egg and of semi-solid, but not distinctly fluctuating consistency; very slight mobility. The tumor fills the space between the uterus and the pelvic wall; the right tube, the uterine portion of which is somewhat thickened, merges with the tumor at its upper aspect; pulsating vaginal arteries; the left adnexa cannot be palpated with certainty. Breasts contain no secretion. January 20, a distinct enlargement is noted in the lower portion of the tumor; softening (succulence) of the vagina and vaginal portion becomes more distinct than before. A diagnosis of a living fetus was made because the tumor was growing, the succulence increasing, there were no uterine hemorrhages, and there had been no discharge of decidua. The diagnosis was confirmed by laparotomy.

There is no absolutely positive sign of life of the fetus during the first half of an extra-uterine pregnancy; it is only by taking into consideration the palpatory findings and the data obtained from the history, as well as the results of observation, that a doubtful case can be cleared up.

The second question to be decided, namely, what operation is indicated, is not so difficult provided one is dealing only with the presence of the ovum in the tube, *i.e.*, a tubal mole. In such cases the tube contains not only the ovum, but also more or less extravasated blood, which accumulates in the lumen of the tube or between the fetal membranes, and in part also flows out of the tube. In these cases the tube is dilated either in part or along its entire length, and sometimes loses its tortuosity and feels hard and tense to the touch. The tumor is recognized as a distended tube and not a hematocele by the fact that it corresponds to the tube in position, and frequently also in shape, and exhibits the same mobility as the tube. If the uterine portion of the tube is not involved, the junction of the normal segment of the tube with the distended portion can be demonstrated. In every case a positive diagnosis that the ovum is situated in the tube requires the demonstration of a hard, distended segment of the tube, and the absence of large extratubal effusions of blood. The constantly recurring attacks of pain also indicate that the ovum has not yet escaped from the tube.

Diagnosis of a Tubal Mole.

A still further refinement in the diagnosis of interrupted tubal pregnancy for the purpose of differentiating between tubal abortion and tubal rupture is possible only in a few isolated cases, and has no special clinical significance because it does not affect either the prognosis or the treatment.

The **diagnosis of extra-uterine pregnancy in the second half** unquestionably presents much less difficulties. It is based chiefly on the demonstration of the fetus outside of the uterus. The first step should always be to look for the fetus. As it usually lies in the gestation-

sac, the clearness with which the fetal parts can be recognized will depend on the thickness of the sac-wall. Sometimes they are recognized very distinctly through the thin walls of the gestation-sac, and their recognition is probably easiest when the fetus has escaped from its envelope and is lying free in the abdominal cavity, immediately beneath the abdominal wall. A fetus in an intraligamentary gestation-sac is more difficult to recognize, but even in this situation it can usually be felt more distinctly than in a case of intra-uterine pregnancy. The recognition of fetal parts by palpation is especially easy when they occupy Douglas' space; for the sutures, fontanelles, as well as crepitation of the bones of the skull may often be recognized. The demonstration of the fetus is much more difficult when it is dead and the resulting changes have taken place. At first the fetal parts become so soft that they are difficult to feel through the abdominal wall; later, if calcification takes place in the outer layers of the fetus or in the fetal membranes (lithopædion and lithokylephopædion), it is of course easier to demonstrate the presence of a tumor, but the identification of a fetus is possible only in very rare cases. If the gestation-sac becomes necrotic and perforation into the neighboring organs takes place, its presence may be recognized by the discharge of fetal bones through the bladder, intestine, navel, or abdominal walls. In addition to direct palpation of the fetus itself, fetal sounds and fetal movements are, of course, also of value for the diagnosis; the latter are characterized by their great distinctness, and the fact that they cause pain. Diagnosis by palpation is probably most difficult when the gestation-sac develops between the layers of the broad ligament and when a considerable period has elapsed since the death of the fetus. In doubtful cases resort may be had to radiography, which may, if the time of exposure is long enough, give a picture of the fetal skeleton, and thus at least demonstrate the presence of a fetus. Marschall succeeded in demonstrating the fetal skeleton even in the presence of calcified membranes; but in a number of cases radiography has failed.

Diagnosis in the Second Half.

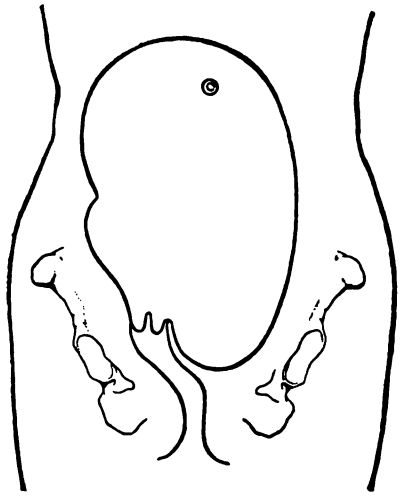

FIG. 84.—LEFT-SIDED INTRALIGAMENTARY TUBAL PREGNANCY IN THE TENTH MONTH. P.-F. ⅙. (Original.) Cystic tumor; vaginal portion on the right side in contact with the pelvic wall; fundus begins at the right aspect of the tumor; the head lies on the vaginal vault, to the left of the cervix. The sutures can be distinctly felt, and parchment crepitation is present.

If the presence of a child has been positively demonstrated, it remains to be decided whether it is intra- or extra-uterine. The examiner endeavors to palpate a fetus or ectopic sac lateral to the uterus. Success will usually depend upon the relation of the gestation-sac to the uterus. If the former is pedunculated, and the uterine portion of the tube is not involved, the outlines of the uterus can easily be made out, even when the ectopic sac is adherent to the organ. Difficulties arise, however, when it is intraligamentary, because in that case it grows close to the uterus, between the layers of the broad ligament, and occasionally even encroaches upon the muscle of the uterine wall, so that, as in the case of any other intraligamentary tumor, it is very difficult to distinguish the outlines of the uterus (Fig. 84). Successful palpation of the uterus depends also on its relation to the ectopic sac. If the latter is pedunculated, it is occasionally found in front of the uterus and behind the abdominal wall—under which conditions the connection between the uterus and the sac is readily recognized (Fig. 85); but in most cases the uterus is in retroversion and can be quite easily outlined through the rectum. In intraligamentary tubal pregnancy the uterus is usually displaced to one side and forward, and lifted out of the pelvis by the growth of the ovum. Accurate examination under anesthesia is absolutely necessary for ascertaining these topographical relations. It must, however, be made with care, and the uterus must not be displaced with the tenaculum, as rupture of the sac might result. The introduction of the sound for the purpose of finding the uterus should, if possible, be avoided. Occasionally a circumscribed, firm resistance, corresponding to the placenta, can be demonstrated in the gestation-sac (Fig. 85).

FIG. 85.—RIGHT-SIDED PEDUNCULATED TUBAL PREGNANCY IN THE TENTH MONTH, WITH LIVING FETUS. P.-F. ⅓. (Original.) The uterus is in anteposition, large and soft; along its right aspect a distinct area of resistance is felt, which can be outlined (placenta) and becomes diffuse farther down. On the left side the fetal back is distinctly felt; X indicates the position of the small parts.

The diagnosis of extra-uterine pregnancy, particularly the differential diagnosis from other tumors, receives additional support in the uterine changes incident to pregnancy. During the second half the uterus is always distinctly enlarged in all its diameters, and in intraligamentary tubal pregnancy the organ is often very much elongated; if the fetus is living, the consistency is very soft and the vagina appears bluish-red and soft. After the death of the fetus these

phenomena gradually disappear again, although they may be demonstrable for some time. In the breasts the same conditions develop as with intra-uterine pregnancy; and likewise after the death of the child puerperal changes take place in the breasts.

In those cases in which the palpatory findings are not sufficient for a positive diagnosis, a few of the data obtained from the history and the symptomatology may be utilized. The statements in regard to amenorrhea are uncertain in this condition, because it is frequently obscured by returning menstruation and irregular hemorrhages; in most cases, however, amenorrhea, at least for a short period, is present. On the other hand, in the fetal movements a new factor arises, for their unusual severity and the severe pain accompanying them often arouse the suspicion of extra-uterine pregnancy. The subjective symptoms of pregnancy are uncertain and often altogether absent. If some time has elapsed since the death of the fetus, menstruation returns, and the only statement obtained in such a case of uninterrupted extra-uterine pregnancy is that the patient some time before was pregnant, or thought herself pregnant, but that no delivery took place.

Case 13. Mrs. B., aged 37. First menstruation at the age of 12 years; always regular, attended with pain. Married at age of 16; subsequent to this time signs of gonorrheal infection. In 1887, two years after marriage, abortion in third month; this was followed by a period of sterility. In September, 1895, menstruation ceased; five months later painful fetal movements were noted which suddenly ceased in the eighth month; in the ninth month a spongy structure (decidua?) and a certain amount of blood were discharged, accompanied by pain. Pain during the entire pregnancy; but no peritonitis, hemorrhages, or cramps. Soon after the menses returned, and since then have recurred regularly every three or four weeks. The tumor, which the patient herself felt in her abdomen, is said to have diminished considerably during the first five years; since then it has remained stationary. The patient complains of pain in the umbilical region and increased desire to urinate.

Present Condition: Protrusion of the lower abdomen by a flat tumor, extending above the navel and laterally a hand's breadth from the median line. Mobility very much limited; consistency very hard, in some places as hard as stone; cervix in the pelvic axis; uterus in retroversion behind the tumor; length 7 cm. The tumor can be felt through the anterior vaginal vault, where it ends in an angular projection of very hard consistency; no connection between the uterus and tumor is demonstrable. Radiography is negative.

The objective findings render the diagnosis of extra-uterine pregnancy impossible, for nothing of a destructive character could be recognized in the tumor. On the other hand, the history was absolutely positive, and without it the diagnosis could not have been made, for a subserous fibroid would probably have been suspected. The diminution in the size of the tumor seemed to confirm the theory of a lithopædion.

The diagnosis was confirmed by laparotomy. The extirpated tumor, which lay free in omental adhesions, contained fetal parts, which could still with some difficulty be recognized; the angular projection below was the calcified placenta.

The disturbances in the course of extra-uterine pregnancy are important in the differential diagnosis from intra-uterine gestation. They consist in the occurrence of irregular hemorrhages, usually of brief duration, attacks of cramp in the abdomen, or more or less severe peritoni-

tis. Extra-uterine pregnancy very rarely goes on to the second half without disturbances of this kind. The diagnosis of fetal death is of course very much easier than in the first half; just as in intra-uterine pregnancy, it is based on the absence of heart sounds, the difficulty of palpating the fetal parts, the cessation in the growth of the abdomen, and the diminution in the size of the breasts. The patient's statement that the fetal movements ceased suddenly—often with chills—also points to fetal death.

In the **differential diagnosis of extra-uterine pregnancy** many different morbid conditions must be considered, because this clinical picture is encountered in many guises. Severe peritoneal collapse, with effusion into the abdominal cavity, may require explanation; in another case a piece of discharged ovum is presented for examination in order to decide whether abortion has taken place or the suspected material comes from the decidua of an extra-uterine pregnancy; again, the decision may have to be made between a tubal tumor of an inflammatory nature and pregnancy; in yet another case the physician must determine, after the presence of a fetus has been demonstrated, whether it is intra- or extra-uterine. Thus the diagnosis presents many different problems which cannot be solved from a single standpoint. I shall, therefore, take up in succession the differential diagnostications that are most important in actual practice, indicating the proper method of arriving at a correct conclusion.

Differential Diagnosis.

1. Free internal hemorrhage and perforation peritonitis. The acute peritonitis which follows perforation of an abdominal organ (stomach, intestine, appendix, pyosalpinx), like rupture of a tubal pregnancy, is very frequently attended with sudden collapse, violent pain in the abdomen, and vomiting. As a rule there is no great loss of blood, but merely the escape of the contents of the ruptured organ, and accordingly the patients do not look anemic; apathy, yawning and air-hunger are usually not present; instead, they appear livid and have the anxious expression of peritonitis, while pain and vomiting are more prominent symptoms. If there still remains a doubt whether an internal hemorrhage or an effusion of the contents of an organ or an abscess has taken place, an exploratory puncture with not too small a needle should be made under aseptic precautions at a point where percussion has previously demonstrated the presence of an effusion. Either blood or purulent fluid will be obtained. The occurrence of blood with rare exceptions points to a ruptured extra-uterine pregnancy, although occasionally even a large quantity of blood may have been shed from some other organ (uterus, liver or spleen). For this

Free Internal Hemorrhage and Perforation Peritonitis.

reason a positive proof of pregnancy is most desirable. If menstruation has ceased, pregnancy is very probable; but the sign is not conclusive, as rupture may occur before the cessation of menstruation; while, on the other hand, amenorrhea is also observed in pyosalpinx terminating in rupture. In the same way, pain in one side occurring before the accident may be due to the presence of an ovum in an abnormal situation, or to disease of other organs (tube, adnexa); hence there will always be some cases in which the diagnosis cannot with certainty be cleared up. The keystone of the diagnosis must always be the demonstration of blood in the abdominal cavity; as soon as this has been demonstrated—if necessary by means of an exploratory puncture—the supposition of a ruptured tubal pregnancy in the case of a sexually mature woman is justified, and the abdominal cavity must be opened.

2. Interruption of a tubal pregnancy and early abortion. As the interruption of a tubal pregnancy in the early months is attended with labor-like pains, the discharge of fetal membrane and hemorrhage, and since these phenomena make their appearance in a woman who states that she is not menstruating and perhaps also presents subjective symptoms of pregnancy, or possibly is herself convinced that she is pregnant, it is very natural that the physician should first think of abortion. If the ectopic sac cannot be demonstrated, or is mistaken for something else, a diagnosis of abortion is frequently made and curettage performed, which is very apt to cause rupture of the extra-uterine sac with internal hemorrhage. This is a fatal diagnostic error, which we encounter but too often in practice; and yet the distinction between the two conditions is not difficult. It is based on the demonstration of the extra-uterine gestation-sac, which is by no means difficult, provided the examination is made with sufficient care; for the tube, after the ovum is expelled, is filled with blood and surrounded by a hematocele which, although it may be small, is usually easy to palpate. Occasionally, especially if rupture has taken place early, the sac may be small and escape palpation. Hence in all cases in which the diagnosis of abortion is not absolutely positive, a second careful examination of the adnexa should be made when the woman is anesthetized for curettement; if a suspicious tumor is found, no instrument must be introduced into the uterus.

Interruption of a Tubal Pregnancy and Early Abortion.

An accurate history may give valuable information. In abortion the labor pains are usually described as mild, dragging and pressing sensations in the sacrum or in the middle of the abdomen; while in tubal pregnancy the pains are usually much more intense, are confined to one side, and are often repeated at long intervals. The nature

of the bleeding may also be of diagnostic value, inasmuch as a severe hemorrhage, with the formation of large coagula, is more in favor of abortion. Examination of the discharged portions of ovum may render the decision quite easy. Every piece of fetal membrane is in favor of abortion; while the bi-lobed, complete decidua, without oval constituents, is discharged by the uterus only during extra-uterine pregnancy. But besides these two there are many other kinds of material from the uterus which cannot be identified even with the aid of the microscope.

3. Uninterrupted tubal pregnancy and intra-uterine gestation with tumors of the adnexa. The physician is not infrequently called upon to make this differential diagnosis when there is an adnexal tumor in a woman who is in the second, or at the most, in the third month of pregnancy. As the history points to pregnancy, and confirmatory objective signs are found in the uterus and vagina, the question arises whether the tumor is an extra-uterine pregnancy and the uterus has at the same time undergone enlargement and softening; or whether the uterus contains the ovum, and the tumor in the adnexa is a small ovarian or parovarian cyst, a one-sided hydrosalpinx, or some other similar neoplasm. It is evident that the possibilities of error are limited by the fact that, on the one hand, the enlargement of the uterus must not be too great—hence most of the errors are made in the second month—if extra-uterine pregnancy is to be assumed; and, on the other hand, the tumor in the adnexa must present the peculiarities of a gestation-sac and its size must correspond to the period of pregnancy. Nevertheless, errors are quite frequent and usually consist in diagnosticating an extra-uterine pregnancy in cases of early intra-uterine pregnancy with tumors in the adnexa. Every gynecologist has probably made this mistake at one time or another, whereas the contrary mistake is exceedingly rare. The reason is partly that completely uninterrupted tubal pregnancy is extremely rare, and partly that every examiner, owing to the frequency of extra-uterine pregnancy and its gravity, is likely to think of it whenever he finds an adnexal tumor associated with pregnancy. The error is serious because it leads to laparotomy. As a matter of fact, innumerable unnecessary operations have been performed for this reason.

Uninterrupted Tubal Pregnancy and Intra-uterine Gestation with Adnexal Tumors.

The differential diagnosis should *a priori* incline to adnexal tumor, because unruptured tubal pregnancies are extremely rare. Too much dependence must not be placed on the palpatory findings in the tumor, because the examination must be made with extreme caution when an unruptured tubal pregnancy is suspected. As a rule, the symptoms of pregnancy in the uterus point the way to a correct diagnosis, because

enlargement and softening are, of course, much more pronounced in intra-uterine than in extra-uterine pregnancy. As in every other case of doubtful intra-uterine pregnancy, the only way to make a positive diagnosis is to wait about four weeks (keeping a careful watch on conditions), and note whether the uterus shows a marked enlargement during that time.

4. Ruptured tubal pregnancy and inflammatory adnexal tumors. The objective signs in these two conditions may be very similar, because in both the tube may appear gradually thickened, dilated, and hard. If, in addition, the recent tubal inflammation has produced softening and discoloration of the vaginal portion, which is by no means rare; if menstruation has ceased or been delayed; if, in the case of salpingitis, pains resembling labor pains have recurred at intervals on the affected side, the resemblance of the clinical picture to that of ruptured tubal pregnancy becomes very great. Under such conditions I myself twice committed the error of mistaking an inflammatory tumor for a tubal pregnancy.

Ruptured Tubal Pregnancy and Inflammatory Adnexal Tumors.

CASE 14. Mrs. L. Last menstruation beginning of October, when a hemorrhage occurred, at first slight but later increasing in severity, and lasting five weeks. The hemorrhage was attended with irregularly recurring severe pains in the sacrum and in the left iliac region, which were frequently repeated, usually in the evening, and always associated with severe hemorrhage. Examination showed to the left of the uterus, which was not enlarged, a tumor having the shape of the tube and becoming smaller as it approached the median line, finally joining the uterus as a thin cord. No tubal changes on the right side; no softening; no secretion in the breasts. On the strength of the history (hemorrhages and attacks of pain) and the physical signs (unilateral tubal tumor) I made a diagnosis of tubal pregnancy, but at the operation found an inflammatory tumor.

The contrary error is also possible. Sittner says that Schauta among 77 cases diagnosed inflammatory adnexal tumors in 7, in which laparotomy revealed a tubal pregnancy. Smith made the same error three times; and a number of other individual cases are reported.

The differentiation between the two conditions cannot in most cases be based on a single infallible sign; the entire history and accurate palpatory findings must be taken into account. The data in favor of tubal pregnancies are: amenorrhea, severe attacks of pain recurring at intervals of days or weeks, protracted hemorrhages without much loss of blood. The physical signs are: distinct signs of softening, unilateral tubal changes, possibly with a soft mass in the neighborhood (blood). The factors in favor of inflammatory tumors are: greater uniformity of the pain, coincident catarrh, fever, severe pain on pressure, and involvement of the other side. The diagnosis may be at once cleared up by the discharge of a decidua.

5. Ruptured tubal pregnancy and appendicitis. The similarity of the clinical picture is brought about by the fact that in inflammatory processes beginning in the appendix there are acute

attacks of pain recurring at intervals and followed by signs of peritoneal irritation and, not infrequently, perforation peritonitis with sudden collapse; and, on the other hand, by the fact that the same phenomena may accompany the development of tumors on the right side, which are taken for blood tumors. Mistakes have often been made in both directions. The diagnosis will incline toward appendicitis if all the data and objective signs of pregnancy are absent and if the tumor is situated higher and more to one side, although occasionally an intraperitoneal effusion of blood may rise equally high. Anemia, slight jaundice, absence of fever, absence of all signs or previous irritation in the appendix are in favor of a ruptured tubal pregnancy; while tenderness in the iliac region, the feeling of a tumor at the site of the appendix, and the objective demonstration of healthy adnexa on both sides, are against that condition.

Ruptured Tubal Pregnancy and Appendicitis.

6. Retro-uterine hematocele and retroflexion of a gravid uterus. A retro-uterine hematocele may, generally speaking, be mistaken for any kind of tumor that may possibly occupy a retro-uterine position, and since it usually has a distinctly cystic consistency, it is most apt to be mistaken for a tumor which contains fluid. The conditions to be considered in the differential diagnosis are: tumors of the ovary and of the tube, and serous or purulent peritoneal exudates. In daily practice, however, the condition is much more often confused with retroflexion of a gravid uterus, not only because of the similar findings but also because the history is similar in both cases (amenorrhea, hemorrhage, pain resembling labor pains). The differential diagnosis of these two conditions has achieved unenviable notoriety in gynecology because it has in many cases been the cause of fatal accidents; for if, as has happened again and again, a retro-uterine hematocele is mistaken for a retroflexed uterus, and attempts are made to correct it, the capsule of the hematocele is ruptured, and a fatal hemorrhage may result. I therefore advise the practitioner to give particular attention to this point. Theoretically the distinction between the two conditions is quite clear. In retro-uterine hematocele the entire uterus must always be demonstrable in front of the tumor; while in retroflexion of a gravid uterus only the cervix is found, and this directly continuous with the tumor. This sign must always be looked for, and in characteristic cases the correct diagnosis may often be made at once by digital examination. Very frequently, however, difficulties arise from the fact that the uterus is too near the hematocele and cannot be differentiated from it; or, if the cervix has attained a certain length, it may be mistaken for the entire uterus; not to mention cases in which accurate palpation is impossible on account of difficulties outside of the

Retro-uterine Hematocele and Retroflexion of a Gravid Uterus.

pelvis, such as thick abdominal walls, etc. Under these circumstances, the aid of other signs must be invoked. Occasionally the direction of the cervix is of value: in retroflexion of a gravid uterus, if the organ is not too large, it is low down and in front of the fundus, pointing backward and upward; while in anteposition of the uterus due to retro-uterine hematocele the external os usually presents directly downward. It is only when absorption begins that the cervix alters its position owing to the gradual retroversion of the uterus. In other cases a positive diagnosis of retro-uterine hematocele can be made by finding the tubes immediately behind the abdominal walls—one of them usually—in a thickened condition. The uterine tumor itself often presents certain differences which can be recognized with certainty. The gravid uterus is uniformly round in all directions and is often easily movable; while the hematocele above—especially in recent cases—has a very irregular outline, and in the pelvis also, owing to the irregular filling of Douglas' space or adhesions with the pelvis, the lower boundary may be irregular, These conditions can best be recognized by an examination through the rectum. The consistency of the gravid uterus is much more uniform than that of a retro-uterine hematocele, and does not change so quickly. Finally, a hint may be obtained from the history and from the symptoms. If there is no disturbance whatever, and the condition is normal, a retro-uterine hematocele is very improbable; while, on the other hand, a history of long-continued hemorrhages, particularly if they occur soon after a short period of amenorrhea or severe abdominal cramps repeated at intervals, is strongly in favor of an hematocele.

7. Retro-uterine gestation-sac and retroflexion of a gravid uterus. A retro-uterine gestation-sac is, even more than a hematocele, apt to be mistaken for a retroflexed gravid uterus. As an extra-uterine pregnancy is still in process of development, the disturbances which lead to the formation of the hematocele will not, as a rule, be mentioned in the history. There are no long-protracted hemorrhages and, on the other hand, the period of amenorrhea is longer and interrupted only by hemorrhages of brief duration. Abdominal cramps also are absent, or, if present, are feeble and of short duration. All the signs of softening are much more pronounced; the tumor is more uniformly round and has a much more distinctly cystic consistency than the hematocele. All these conditions in a given case produce a similarity to retroflexion of a gravid uterus. The differential diagnosis from retroflexion of a gravid uterus is based on the same points as in the case of hematocele. Demonstration of the entire uterus in front of the sac is conclusive; later the parts belonging to a young fetus may be found in Douglas' space.

Retro-uterine Gestation-sac and Retroflexion of a Gravid Uterus.

8. Extra-uterine, and intra-uterine pregnancy. Mistakes in regard to the site of implantation of the ovum are possible at any period of pregnancy. From the first to the last month the difficulties in the way of a correct diagnosis, in this respect, may be so great that even a practised diagnostician may come to grief. In general it may be said that here again an extra-uterine pregnancy is more frequently incorrectly diagnosed than an intra-uterine, and accordingly the number of unnecessary laparotomies is by no means small. This tendency to diagnose extra-uterine pregnancy too frequently is in part due to the fear of overlooking the condition. Any abnormality in the uterus that presents even a remote similarity to extra-uterine pregnancy is at first looked upon with suspicion, and then incorrectly interpreted. The mistake occurs in cases of pregnancy in which the diagnosis is absolutely positive, both by the history and by the physical signs, but in which certain conditions in the uterus make it difficult to decide whether the fetus is developing within or outside of the uterine cavity. It is almost needless to say that confusion can arise in extra-uterine pregnancy only when the ovum is attached in the immediate vicinity of the uterus, or develops between the layers of the broad ligament and lies close to the organ.

Extra-uterine, and Intra-uterine Pregnancy.

Diagnostic errors are more frequently due to certain special conditions in the wall of the gravid uterus:

(*a*) The irregular contractions (see page 128), which cause the uterus to assume a very irregular shape, the contracted portions being hard and small, and the non-contracted portions large and flaccid. If the former happens to occupy the junction between the vaginal portion and the uterus, the examiner will receive the impression of a uterus of about normal size in that situation, and the soft portion along the side will appear to be a gestation-sac; if for any reason this condition is associated with hemorhrage, the suspicion of tubal pregnancy is increased.

Case 15. Mrs. v. B. Last menstruation November 7, 1903; when on February 4, 1904, hemorrhage occurred after an injury, a specialist was called. He believed that he felt a tumor in front of the uterus; in the subsequent examination, under anesthesia, made for the purpose of confirming the diagnosis, he distinctly felt a soft tumor, broadly attached to the uterus, which was hard to the touch and situated behind the tumor. As he made a diagnosis of extra-uterine pregnancy and declared that an operation was necessary, I was consulted. While on the next day the findings were exactly the opposite—the soft segment being on the right and the harder portion on the left—I could also detect without difficulty that the two segments together formed the uterus, which was in the ordinary state of pregnancy. After six months the woman was easily delivered of a full term child.

These contractions never last long and often disappear during palpation; if there is any doubt, it is easily removed by waiting and examining the patient again.

(*b*) The projections on the uterine wall over the site of implantation (see page 129) may also produce a picture suggestive of extra-uterine pregnancy, because part of the uterus undergoes eccentric enlargement and presents a soft consistency, while the part not occupied by the ovum appears harder and smaller. The former is then mistaken for the gestation-sac, and the latter for the uterus, and the longitudinal furrow in the uterine wall, which is so often associated with this phenomenon, heightens the mistaken impression. As the supposed gestation-sac is very close to the uterus, with a broad connecting surface, an interstitial, or at the most an isthmic pregnancy is the condition most likely to be suspected. A correct diagnosis can easily be made under anesthesia by demonstrating the gradual transition from one portion to the other, and particularly if a labor pain occurs during the examination, the tumor at once gives the impression of a simple gravid uterus. Palpating the beginning of the adnexa beyond the soft tumor also confirms this diagnosis.

(*c*) During the fourth to the sixth month fresh difficulties in the solution of this question arise on account of the marked softening of the lower uterine segment, as the result of which the gravid uterine body may form an angle with the cervix and occupy a lateral or posterior position with respect to it. In such a case the cervix, the upper extremity of which can be felt through the soft uterine wall, is mistaken for the entire uterus, particularly if it is elongated and hard; and the body of the uterus, which lies to one side, for the extra-uterine gestation-sac. This is an exceedingly common error and is quite often recognized only during laparotomy performed for the purpose of extirpating the supposed extra-uterine gestation-sac. The best way to avoid this error is through an examination under chloroform anesthesia. The body is brought into the median line and in this position, particularly if the fingers are carried upward along the lateral aspects, the transition to the vaginal portion is readily recognized. Another good way is to palpate with the examining fingers wide apart so as to grasp the vaginal portion between them, and then to push one of the fetal parts, the head if possible, between the fingers from above. By this manœuvre it is easy to decide whether the fetal part is in the uterine segment or to one side. Often the diagnosis can also be assured by finding the round ligament and the ovaries. The history may give valuable information in so far as the absence of disturbances in the course of pregnancy up to the time of examination is in favor of intra-uterine, while the above mentioned disturbances point to extra-uterine gestation.

Case 16. Mrs. H. In 1891, I was summoned to a large city in Russia to perform an operation in a case of extra-uterine pregnancy. On my arrival I found everything ready for the operation. The history which I obtained from my colleague, a specialist of recog-

nized ability, aroused my astonishment because there had been no disturbance of any kind (no hemorrhage, no pain) during the five months that the pregnancy had lasted. Under chloroform anesthesia I at once recognized the error. My colleague had mistaken the body of the uterus, which was displaced to one side and retroflexed, for the gestation-sac, and the cervix for the entire uterus. As soon as I elevated the body and brought it into the proper relation with the cervix, it became evident that the case was one of ordinary intra-uterine pregnancy. The junction between the cervix and the body was distinctly recognized along the lateral aspects.

(*d*) During the last months the differential conditions become more and more favorable, although even at this time difficulties may arise if the gestation-sac, especially when it has developed between the layers of the broad ligament, is so close to the uterus that the latter cannot be demonstrated with absolute certainty. The median position of the cervix, or the course of the round ligament, occasionally supplies the necessary information. Not infrequently the thickness of the uterine wall overlying the fetal portions helps to solve the question whether the fetus lies within the thin gestation-sac or whether it is covered by the thicker uterine wall. There can be no difficulty in demonstrating the parts of a living full-term fetus if it is merely covered by thin fetal membranes; and, on the other hand, the diagnosis of intra-uterine pregnancy is positive if a muscular wall, or even one capable of contracting, is felt between the fetal parts and the palpating hand. Difficulties of various kinds, however, arise to mar the value of this sign. Thus in the case of ill-nourished multiparæ, the uterine wall may be so thin that one apparently feels the fetal parts directly under the abdominal wall; on the other hand, there may be inflammatory thickening of the wall of the gestation-sac, or the latter may be so deeply placed that the fetal parts cannot be reached through the abdominal walls; or again the wall of the gestation-sac, in the case of intraligamentary pregnancy, may be considerably thickened by the connective and muscular tissue; and finally, the fetal parts themselves may no longer be palpable because of death and maceration of the fetus. The greatest difficulties in this respect are encountered in intraligamentary pregnancy when a long time has elapsed since the death of the fetus.

Finally, if every means of settling this question proves futile, it may be permissible to make a cautious use of the sound in order to demonstrate whether the uterine body is empty. I consider this permissible, however, only when the fetus is positively known to be dead. The diagnostic difficulties are illustrated by the following case:

Case 17. Mrs. W. believes herself to be pregnant since September, 1887. In October, 1888, the shape and distention of the abdomen were found to correspond to the last months of pregnancy. The abdominal tumor, which could be distinctly outlined, was of about the shape of the gravid uterus; the surface was uniformly smooth, and the tumor extended upward beyond the navel. On vaginal examination, I found that the tumor extended

into the pelvic inlet, where the fetal skull could be distinctly felt. The cervix occupied the left posterior quadrant and could be outlined only for a short distance. The history showed amenorrhea since September, 1887, and numerous irregular hemorrhages during the course of the pregnancy; two severe attacks of peritonitis; no discharge of decidua; and cessation of fetal movements in June, 1888, accompanied by chills and another attack of peritonitis. The diagnosis lay between missed labor and intraligamentary or extra-uterine pregnancy. The history pointed to the latter, the physical signs favored the former. An attempt was made to demonstrate that the uterus was empty. The results of sounding were not positive; it showed a length of 10.5 cm. The cervix was accordingly dilated with laminaria tents, and even then I could not introduce the finger beyond the internal os, but I could now determine with absolute certainty that the cervix was entirely separated from the gestation sac. Laparotomy showed an intraligamentary tubal pregnancy on the right side.

Extraordinary diagnostic difficulties may arise when extra-uterine and intra-uterine pregnancy exist at the same time. This complication is not so rare but that it might occur in the experience of any practising physician. Up to 1904 Neugebauer collected 155 cases from the literature, 19 of which occurred in the year 1903. A case of this kind is usually brought to the physician's notice under circumstances somewhat like the following: An extra-uterine pregnancy has caused disturbances—such as internal bleeding, or attacks of pain with slight external bleeding—while the intra-uterine pregnancy continues to develop normally; or, less frequently, an intra-uterine abortion occurs while tubal gestation is still in process of development. Depending on the duration of the intra-uterine pregnancy, the latter is overlooked, and the entire process regarded as tubal; or the intra-uterine pregnancy is positively recognized and the internal hemorrhage is referred to some other organ; or a hematoma alongside of the uterus is mistaken for a neoplasm or an exudate. This last mistake, which is probably made oftener than any other, is the more serious of the two, because an operation which would save the patient's life is not performed.

On the whole, it is most important for the physician to demonstrate the presence of extra-uterine pregnancy, which must be done by the above mentioned signs, except that discharge of the decidua is absent. In some cases it may be possible to diagnose a coexisting intra-uterine pregnancy if the uterus is especially soft and enlarged and the vagina is very much softened and discolored, particularly if the case is one of ruptured tubal pregnancy. If the intra-uterine pregnancy is already so far advanced that it is recognized at the first glance, one must nevertheless adhere to the diagnosis of tubal pregnancy if the symptoms are marked, because rupture of a gravid uterus, which might produce a picture similar to that of a ruptured tubal pregnancy, is exceedingly rare during the early months. During the later months the intra-uterine pregnancy becomes more and more prominent, while the extra-uterine gestation-sac with the fetus, which is usually dead by this time, lies behind or to one side of the uterus.

As a rule, it is mistaken for a neoplasm, unless an accident reveals the presence of fetal parts within it.

Weibel reports as follows concerning the diagnostications made in cases of this kind: In one case a correct diagnosis of both kinds of pregnancy was made before the occurrence of any disturbance; in 10 cases the diagnosis was made after the occurrence of rupture; in 26 cases during abortion or parturition; in 36 after abortion or parturition; in 25 during the operation on the tubal pregnancy; and in 8 after the operation for tubal pregnancy.

It follows, therefore, that only in 11 out of 104 cases was the diagnosis correctly made at a time when the physician was still entirely master of the situation.

Rarer Forms of Extra-uterine Pregnancy. In most cases the physician will make the general diagnosis of extra-uterine pregnancy and, on account of its frequency, will be justified in assuming it to be tubal. Under specially favorable conditions, however, it may be possible to differentiate the kind of pregnancy in the living woman, for example, in the case of an interstitial or ovarian pregnancy, or one situated in a rudimentary cornu. Because extra-uterine pregnancy in the fimbriæ and tubo-uterine pregnancy are anatomically so difficult to characterize, a clinical diagnosis is out of the question.

Interstitial gestation, *i.e.*, implantation of the ovum in that portion of the tube contained in the uterine wall, produces certain special signs which may possibly be recognized. The ovum developing alongside the upper part of the fundus causes a marked upward displacement of the corresponding uterine cornu, which becomes more and more marked; while the other cornu is pushed downward, so that the uterus lies in an oblique position with the gravid cornu directed upward. Accordingly the origin of the adnexa on the two sides is very different; on the non-gravid side low, and on the gravid side high up on the gestation-sac (Ruge's sign). The round ligament passes outward from the gestation-sac, making it possible in some cases to differentiate it from a pregnancy in the rudimentary cornu. So far as its physical signs go, it most nearly resembles rupture of the gravid uterus, from which it may be distinguished, however, by the fact that rupture in the former almost always occurs during the first half of pregnancy, while in the latter rupture takes place during the later months.

Ovarian gestation may be suspected clinically when, in the presence of a positively recognized extra-uterine gestation-sac, the tube is found free along its entire extent and without any connection with the gestation-sac. The physical signs, however, are hardly ever definite enough to make such a diagnosis.

In contradistinction to the two last mentioned varieties, gestation in a rudimentary cornu of the uterus presents an abnormality which can always be positively recognized, albeit with great difficulty. The clinical picture and the physical signs may, it is true, be quite different, depending upon whether the gravid cornu has a

short or a long pedicle, whether the fetus continues to develop or dies and is retained, and lastly whether the symptoms of rupture have already occurred.

For the diagnosis of pregnancy in a rudimentary cornu it is necessary, in the first place, to demonstrate a tumor corresponding to a gestation-sac alongside the non-gravid cornu of the uterus. The pregnancy as such is easy to demonstrate objectively in the accessory cornu if the fetal signs make their appearance during the second half. During the first half the doughy consistency of the cornu may arouse a suspicion of the true state of affairs. If, as very frequently happens in the rudimentary cornu, the fetus dies, all signs of pregnancy soon disappear and there results a globular tumor on one side of the uterus which may in every respect resemble a neoplasm—either a solid ovarian tumor, if the connecting band is long, or a subserous myoma, if it is short and thick. Sometimes contractions occurring spontaneously, or following traumatic irritation, may reveal the pregnancy. In the main, the physical signs of a gravid rudimentary accessory cornu correspond to those produced by a simple gravid uterus, but there is considerable deviation of the tumor from the median line. In the beginning the gravid cornu is markedly oblique and situated to one side, gradually it rises out of the pelvis, and during the latter part of the time may be almost in the median line if the band which connects it with the non-pregnant cornu allows it sufficient mobility. The non-pregnant cornu alters its position in the same degree; at first it is oblique, but gradually it is crowded more and more downward into a position of anteflexion or retroflexion. The presence of a gestation-sac is also suggested by the signs of softening in the genitalia, in which the non-gravid cornu also takes part, undergoing slight enlargement and softening. After the death of the fetus these phenomena subside. In the history there is nothing characteristic to distinguish the condition from an ordinary pregnancy, if no symptoms of rupture have occurred; if rupture takes place, as happens in about half of the cases, the symptoms resemble those of a tubal pregnancy. Not infrequently the discharge of the decidua assists in establishing the diagnosis of pregnancy, and its cylindrical shape, with only one cornual point and one tubal orifice, may confirm the diagnosis of a bicornute, gravid uterus.

Another requisite for the diagnosis of pregnancy in a rudimentary cornu is the demonstration of the connecting band between the gravid, and the normally developed non-gravid cornu. The thickness of the connecting piece is subject to great variation, from the thickness of the thumb to a mere membranous plate, softened by the pregnancy and barely recognizable. It may be so short that the two portions of the uterus are scarcely separated, while in another case there may be a con-

siderable interval between them. Hence the physical signs in a case in which pregnancy has been definitely established may be those of interstitial pregnancy; or, if the connecting piece is of uniform thickness, those of pregnancy in a bicornute uterus; while, on the other hand, if the connecting piece is long and thin, a pregnancy in the lateral portion of the tube or even in the ovary, may be simulated. In the last case the true state of affairs is revealed by the course of the round ligament, which shares in the general hypertrophy incident to pregnancy and is usually quite easily felt; it runs from in front upward to the fetal sac and usually loses itself in the anterior and upper part of the sac. In this way the enlargement is recognized as the uterus and is sharply distinguished from a tubal gestation-sac.

Occasionally the coincidence of a double vagina may suggest the possibility of pregnancy in a uterus bicornis. The diagnostic difficulties in pregnancy in a rudimentary horn are shown by the following case:

Case 18. Mrs. W. presents a tumor about as large as a man's head, round, very hard and firm, and under anesthesia exhibiting a moderate degree of mobility. The uterus is felt to the left of the tumor and separate from it, and has a length of 7 cm.; the left adnexa are normal, the right cannot be felt; no softening or discoloration of the vagina. According to the objective signs, a diagnosis of a right-sided ovarian tumor (dermoid) would have to be made; but the history is absolutely conclusive of extra-uterine pregnancy. The woman was about 28 years old, had been married eighteen months, and had had her last menstruation on the 10th of April, 1894; on the 11th of February, 1895, two flat, fleshy fragments, about 4 to 5 cm long, were passed. Four weeks later there was discharge of bloody mucus, and after that amenorrhea until the present time (beginning of May). On the 17th of September, 1894, there had been distinct fetal movements lasting three weeks. Swelling of the breasts, which exuded milk, took place after the supposed death of the fetus. Since January, 1895, the abdomen is said to have diminished in size. From this history a definite diagnosis of pregnancy could be made, and the physical signs made it possible that the fetus had developed in the extreme lateral portion of the tube, although the firmness and mobility of the gestation-sac were not in accord with this diagnosis. Laparotomy showed a gestation-sac almost as large as a man's head in the extreme lateral portion of the right rudimentary cornu, with the right adnexa and the round ligament inserted into its outer surface. The connection between the gestation-sac and the fully developed uterus was thin, muscular, and without any lumen; the fetus was macerated.

Microscopic Diagnosis of Pregnancy.

The diagnosis of pregnancy can either be made by the clinical signs, or it may be based on the result of macroscopic and microscopic examination. The anatomic diagnosis is based on two different points. First, the recognition of the products of conception, *i.e.*, the fetal parts; and, second, the demonstration of changes produced in individual maternal tissues by pregnancy. Either maternal or fetal parts alone, or the two together, suffice for the diagnosis.

Products of Conception and Changes Incident to Pregnancy.

With respect to the **macroscopic** examination of the products of conception, an ovum expelled *in toto* is recognized by the villi which

surround it, and by the contained embryo or its remains. During the earliest part of pregnancy the embryo may disintegrate and become in part absorbed; quite often nothing remains but the umbilical cord, with a small piece of the embryonal abdominal wall in the shape of a yellowish-white particle. The remnant of the umbilical cord suffices for the diagnosis. During the first weeks the ovum may be expelled (1) free, without any envelope, or at most with a few small particles of the decidua basilaris (maternal parts) clinging to the tips of the villi; or (2) the material presented for examination may be a three-cornered structure, with a rough, uneven outer surface corresponding in shape to the lining of the somewhat enlarged uterine cavity; the structure is hollow, and on being opened is found to be slightly thickened and convoluted, but presents nevertheless smooth, irregular polygonal fields, and punctate areas corresponding to the orifices of the uterine glands. This is the decidua; and its discharge assures the diagnosis. The rough, somewhat villous outer surface corresponds to the implantation site; the deepest portion of the altered mucous membrane always remains behind. Occasionally a minute scrutiny of the material discharged in abortion in the second or at most the third week, will disclose the ovum still adherent to the expelled decidua (compare Fig. 100). The spot where the ovule is lodged (from ¾ to 1 or 1¼ cm. in diameter) is usually slightly depressed at the centre and thickened at the periphery, and the surface is somewhat smoother than the surrounding parts. In such a case, therefore, the ovum is expelled along with the uterine membrane altered by gestation, and the diagnosis is established. During the second to the third month it is rare that the entire lining of the uterus, with its connection with the fetus, is discharged. The ovum surrounded by the capsularis merely has a small piece of vera attached to it, while most of the basilaris adheres to the expelled specimen; hence, during the later months only parts of the maternal tissue and fetal parts are expelled. The products of conception, the ovum with its membranes, chorion and amnion, may also be incomplete in these abortive discharges. Sometimes the embryo or fetus is absent and only the membranes are obtained during the second to the third month; after the second to the third month, the total product of gestation, as has been mentioned, is never expelled in conjunction with the entire altered mucous membrane. A variable portion of the mucous membrane, both vera and basilaris, always adheres to the uterine wall, the muscular layer is laid bare in small areas. — With regard to the macroscopic examination of the maternal parts a distinction must always be made between the first and the second half

Macroscopic Examination.

Ovule in the Decidua.

Gestation from Second to Third Month.

Maternal Parts.

of pregnancy. The decidua reflexa, that part of the uterine mucosa which surrounds the ovum, is smooth and yellowish-white from fatty changes and the deposition of fibrin. Here and there it exhibits red marbling from the presence of small extravasations. The surface shows large flat depressions corresponding to the orifices of the enlarged uterine glands. The reflexa becomes fused with the decidua vera at its point of reflection, over the ovum. The decidua vera, expelled in early months of pregnancy, presents a number of furrows which apparently divide it into polygonal fields of varying size. The uterine glands, which cannot be seen with the unaided eye in the non-gravid state, are distinctly recognized as minute openings. The surface appears cribriform (lamina cribrosa), cross-sections distinctly show enlarged vessels of the mucous membrane, and in its deeper layers, immediately above the muscularis, the dilated glands are visible. The mucous membrane in cross-section is seen to be distinctly divided into a compact upper, and a spongy deeper layer, and its thickness may be as much as ½ cm.—In abortions the decidua vera is usually detached in the deep layer of the compact, or in the upper layer of the spongy portion, and when expelled, appears rough and shaggy (see above). Demonstration of the decidua suffices for the diagnosis.

(*a*) Decidua Reflexa.

(*b*) Decidua Vera.

The decidua basilaris (formerly called serotina) is practically never expelled by itself; it is connected with the ovum, to which it is firmly adherent, at the so-called placental site. It is, therefore, usually expelled with the ovum; but during the earlier periods of pregnancy the greater part of it may remain behind in the uterus, in which case the expelled ovum presents villi at the point where otherwise the decidua serotina (basilaris) would be found. The decidua basilaris forms the so-called maternal portion of the placenta in a full term pregnancy. If the decidua basilaris (serotina) remains behind in the uterus it is usually removed on account of some disturbances occurring after abortion, either with the curette or with the finger. In abortion the basilaris is often compressed and sometimes drawn out in length by the act of expulsion. The individual products, the villi or decidua, and the fetal or maternal parts, can usually be recognized separately by careful examination according to the above directions, and thus assure the diagnosis. If the individual parts are retained for some time in the uterus after abortion and become saturated with blood and compressed by the labor pains, the structures known as moles, or blood moles, are produced.—Unless the material expelled is definitely proved to be some fetal or maternal product of pregnancy, or of the changes incident to pregnancy, the diagnosis between abortion and a mucous polyp or a myoma

(*c*) Decidua Basilaris.

Mole, Blood mole.

saturated with blood, or coagula and masses of fibrin, must remain in doubt. Decidual tissue always assures the diagnosis of pregnancy, but does not tell us whether we have to deal with a tubal or a uterine gestation.—Hence the macroscopic diagnosis of pregnancy is based on the demonstration of fetal or maternal parts.—But there are certain structures of the uterine mucous membrane and of the uterus, such as necrotic myomata, or even blood-clots, which, owing to their villous appearance, resemble placental villi and likewise often closely resemble fetal parts in shape, so that it is impossible to make a diagnosis by macroscopic inspection. Even the material obtained by curettage in cases of retained decidual tissue may not be sufficiently characteristic for a macroscopic diagnosis. In such cases a microscopic examination is essential for a diagnosis. Although the latter must be the final resort in many cases, the macroscopic examination must nevertheless not be neglected, for it furnishes valuable information and renders the subsequent work of the microscopist easier.

Microscopic Examination.

The **microscopic** examination, like the naked-eye inspection, has for its object the demonstration of the products of conception, or of alterations in the tissues incident to pregnancy. The important essentials for the diagnosis are the recognition of the villi (fetal parts) and the decidua (maternal parts).

Demonstration of Fetal and of Maternal Parts: Villi, Decidua.

The shape of the chorionic villi varies in the different periods of pregnancy; they are the carriers of the fetal blood-vessels, both afferent and efferent; are largest in the chorion, where they originate; and divide and subdivide again and again down to their terminal branches. The simile of a "villous tree" is most apt.

Chorionic Villi.

We can speak of the trunk and of the branching limbs. The villous tree with its ramifications is situated between the chorion and the decidua basilaris; the trunk is attached to the chorionic part and the terminal branches to the decidua, while another part ends free in the open spaces of the villous tree. In the intervillous space the trunk is thickest at its point of origin, and the branches become thinner and thinner as they undergo subdivision, the thinnest parts being the terminal branches. Like the trees in a dense forest the trunks are far apart, while the terminal branches are close together.—Two parts are distinguished in the villi: the villous stroma, and the epithelial covering of the villi. The stroma (during the earliest stage) consists of connective tissue, which usually has the type of embryonal tissue and resembles the stroma of the umbilical cord.—In the mucin-containing ground substance (myxomatous tissue) of the stroma lie the cellular constituents, which are round, spindle-shaped, or stellate, with delicate

Intervillous Space.

(a) Villous Stroma.

processes that anastomose with one another. The stroma cells stain but faintly, even the nucleus does not take the stain well, and the villous stroma in a stained microscopic section accordingly appears translucent and pale. The villous trunks and the larger branches contain the arteries, which have well-developed muscular walls, while the veins are very wide. As the terminal branches of the chorionic villi are approached, the vessels lose their arterial and venous character, and the terminal branches themselves consist merely of capillaries with a distinctly recognizable endothelium. The latter form

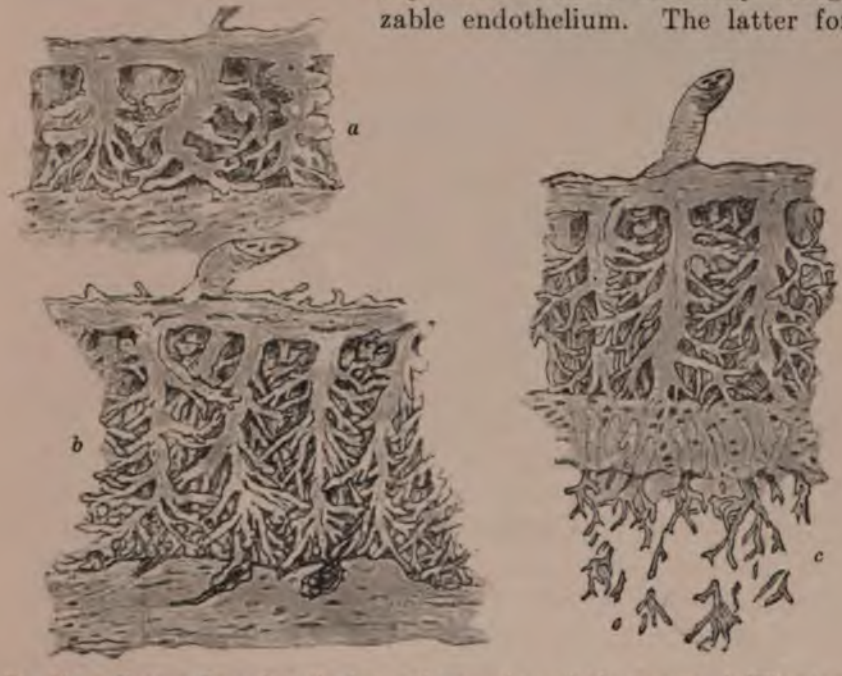

FIG. 86.—*a*, VILLOUS TREE, from the first to the second month of pregnancy. *b*. Villous tree at the end of pregnancy. *c*. Villous tree (six months), showing the villi dipping down deep into the maternal tissues, i.e., the vessels. (Original.)

a small-meshed capillary network, and gradually unite again to form larger veins in the large villous trunks. The veins bring the arterial blood back to the fetus.—As in the pulmonary alveoli the vessels project somewhat into the lumen, so the capillaries in the terminal branches come close to the surface and often produce a slight bulging of the epithelial investment. The structure of the stroma varies somewhat at the different stages of pregnancy. During the early stages the term myxomatous (embryonal tissue) is quite descriptive; during the later months, especially in the larger trunks, the stroma assumes the character of a firm, fibrillar, fibrous connective tissue. During the early stage of pregnancy the villi are short in comparison to the later stages, thicker, more shapeless, and show less ramification (Fig. 86, *a*).

In the earliest stages the villi are small, bud-like, epithelial products, which invade the chorionic tissue along with the chorionic vessels—the mesodermal connective tissue grows into the ectoblast. —The most abundant ramification of the villous tree, and at the same time the greatest attentuation of the terminal branches (Fig. 86, *b*), is seen at the end of pregnancy; in the early stages there is slight ramification and the terminal branches are thick and strong (Fig. 86, *a*). While even the gross structure of the stroma necessitates a comparison between the earliest and the latest stage, such a subdivision, according to the various periods of pregnancy is particularly indicated in the study of the epithelial investment.

As compared with its appearance during the later months, the epithelial covering of the villi possesses a special composition during the early months of pregnancy; the period of pregnancy can be inferred from the character of the villous epithelium. Hence the villous epithelium is of considerable importance in the decision of certain definite diagnostic questions as, for example, between abortion and a pregnancy of some duration. Let us first study the villous epithelium of the first two to two and a half months. At this time the epithelial covering consists of two parts, and the earlier the pregnancy, the greater the difference. The first part, the external covering, which separates the villi from the intervillous space, is a finely granular and, therefore, somewhat opaque mass of protoplasm, which stains fairly well and contains here and there some vacuoles and many round or approximately oval nuclei. The nuclei stain well; they are arranged in a single row, side by side; but the earlier the stage of pregnancy, the greater the probability of having two nuclei superimposed one upon the other. No cellular outlines are to be seen anywhere in the mass of protoplasm, which covers all the villi and their entire ramification and is distinctly seen at the chorion, where it forms the boundary between the villi and the intervillous space. It also covers part of the basilaris, encroaching on its surface from the villi which adhere to it. The protoplasmic mass, without cellular outlines, is found during the entire duration of pregnancy, but its thickness diminishes and the shape of the nuclei changes. —During early pregnancy, which will be discussed first, the thickness of the mass is quite considerable and fairly uniform on the trunk and on the branches of the villous tree, being about twice the diameter of the round, or approximately oval nucleus. The protoplasmic mass without cellular outlines, which covers the villi, represents a syncytium: the epithelial investment is briefly called the syncytial covering of the villi, or simply **syncytium** (Fig. 87).

(*b*) Epithelial Covering of the Villi.

During the First Two to Two and One-half Months Two Parts are Distinguished.

1. Syncytium.

The second part of the villous epithelium is formed of cells which lie underneath the syncytium; the more recent the pregnancy, the more distinct is this cellular layer. It consists of pale, vitreous, translucent elements, often resembling squamous epithelium, the villous body of which does not take the stain, while the nucleus stains very well.—In the microscopic picture, even under low magnification, the two layers and the subjacent syncytial layer are readily distinguished by the different tingibility of the individual parts. This second layer is a true cellular layer; but occasionally the individual elements form a bulging, here and there, so that it appears as if the cells were pressed into the stroma of the villus instead of its surface. This

2. Ectodermal Cells.

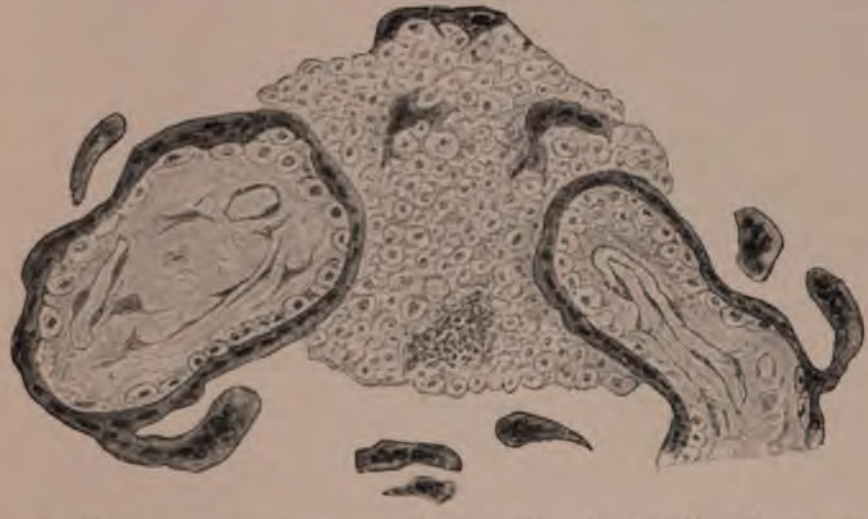

FIG. 87.—TRANSVERSE AND LONGITUDINAL SECTIONS OF VILLI (fourth to fifth week). Syncytial (epithelial) processes—some of them lying free—Langhans' (ectodermal) cellular layer under the syncytial covering of the villi; proliferation of Langhans' cellular layer with syncytial elements connecting the two villi. (Original.)

second layer, which consists of distinctly separate elements, is called the ectodermal layer or **Langhans' cellular layer.** It was formerly erroneously supposed that this second layer was fetal in origin (hence 'ectodermal'), while the syncytium was maternal. The epithelial covering of the villi (syncytial and Langhans') is fetal in origin; the so-called ectodermal cell (Langhans' cellular layer) forms the matrix of the syncytial layer (Spuler). This ectodermal layer possesses a diagnostic value, as the typical, distinctly regular arrangement occurs only in the first two or two and a half months.

Fetal Origin of Syncytium and Ectodermal Layer.

The epithelial covering of the villi during the first two or two and a half months, which we have just studied, presents, in addition to the two epithelial layers (the syncytial and Langhans' cellular layer) certain other peculiar formations: 1. The so-called epithelial hoods at

the ends of the villi; and 2. the epithelial processes, which may be found at any point of the epithelial covering.—The epithelial hoods often cause considerable thickening of the syncytial covering at the tip or extremity of the villi, and may contain large nuclear accumulations. These structures bear an intimate relation to the growth of the villi (lengthwise growth): the stroma grows into the protoplasmic mass and the latter continues to increase so long as the lengthwise growth of the villus goes on. The epithelial processes ("villous plugs") represent outgrowths of the syncytial investment and may present various forms. They may be long or short, attached to the surface like polypi or with a broad base, or connected with it by a long-drawn-out pedicle, preparing thus for constriction and subsequent separation, "tear-shaped," "fig-like," etc. There is no doubt that many of the epithelial processes, which like the covering of the epithelial hoods are "syncytial," separate from the protoplasmic mass and remain free in the intervillous space. They may from this point reach the blood-vessels and enter the maternal circulation (see below).—The number of nuclei contained in the epithelial processes varies. The nuclei stain intensely and in the microscopic preparation, owing to their accumulation in the processes, produce conspicuous dark masses adhering to, or alongside of the villi.—The protoplasm of the epithelial processes is finely granular in the larger ones, and presents here and there some large, glistening corpuscles. In the smaller processes it is thin and drawn out more homogeneously, and contains vacuoles.

Epithelial Processes, Epithelial Hoods.

Separation of the Epithelial Processes.

The epithelial processes are also connected with the growth of the villi; but they more frequently represent, so to speak, the excess of epithelial investment, which undergoes a superabundant proliferation during the growth of the villus. As the growth begins to diminish, the epithelial processes (villous plugs) disappear; later the growth continues more slowly and more systematically, but at the same time imperceptibly forward. The epithelial processes disappear between the fifth and sixth months of pregnancy, *i.e.*, at a time when the growth of the placenta has not as yet ceased.—Just as the ectodermal layer (layer of Langhans) may be utilized diagnostically during the first two to two and a half months, so the epithelial processes represent diagnostic features, characteristics of villi from the first five to six months.

In addition to the epithelial hoods and epithelial processes (the proliferation of the villous covering of the villi at their extremities and along the trunk), there are other most important and most interesting processes which affect our conception of the pathologic processes (chorionepithelioma malignum or syncytioma malignum). They are the benign proliferations of the entire epithelial investment (both the

syncytial portion and the layer of Langhans); the epithelial hoods and epithelial processes usually present only proliferation of the syncytial investment (see below, syncytioma benignum).—The villi of the early months (up to the sixth or eighth week) even to the naked eye, particularly if the villous tree is floated out in water, exhibit delicate, grayish-white round particles which may be compared to the fruits of the villous tree hanging from its branches, and represent proliferations of the villous covering. The microscopic picture is somewhat less uniform.—The villous branch, or villous hood, in the microscopic preparation exhibits bud-like proliferations broadly attached to the villus. At first these proliferations retain their covering of syncytial protoplasmic mass which, however, is visibly distended, as if it were torn in

Proliferation of the Entire Villous Covering: Syncytioma Benignum.

FIG. 88.—APEX OF A VILLUS (fourth to fifth week): *a*. Proliferation of Langhans' cellular layer; bud-like eruption of the proliferation into the intervillous space. *b*. Higher magnification. (Original.)

places. One gets the impression that the protoplasmic envelopes were trying to separate. They cover a mass of cells which is distinctly seen to be connected with the layer of Langhans—vitreous, translucent elements with nuclei that stain much less deeply than the nuclei of the syncytial masses.—We have to deal with a proliferation of Langhans' layer only, causing distention and attenuation of the overlying layer. Proliferation of this kind is also seen at points where Langhans' layer has broken through the syncytial investment: syncytial derivatives are found in the accumulation of Langhans' cells (Fig. 88, *b*). As the villus continues to grow, large masses of cells, which can be seen with the naked eye and which we have just compared to the fruits of the villous tree, are produced.—These proliferations may cause agglutination of adjacent villi at their apices (Fig. 87); the bifurcations of villi due to division of the apex may be filled with these proliferations of the syncytial covering. As a rule the proliferation of the cells of Lang-

hans preponderates; the syncytial parts are apparently more passive, although since the proliferation is often very great, it is possible that the syncytial portion also takes part in it.—If we call the epithelial covering briefly 'chorionic epithelium,' since the syncytial portion is a derivative of the layer of Langhans, we may say that the chorionic epithelium consists of two layers: the ectodermal (in close apposition to the villous stroma), and the syncytial layer, which every-

FIG. 89.—VILLI AT THE END OF PREGNANCY: Syncytial covering very thin; Langhans' layer, cellular layer, no longer demonstrable; arrosion of the maternal vessels, encroachment of the villi on the lumen. The decidua basilaris contains a few so-called syncytial wander-cells. (Original.)

where covers the villi.—Hence these epithelial proliferations may be designated chorionepithelioma benignum (in contradistinction to chorionepithelioma malignum).—These epithelial proliferations will be referred to again in connection with the attachment of the chorionic villi to the decidua basilaris (serotina), and also in connection with hydatid mole.

There is no doubt that the difference in the appearance of the various epithelial layers—the syncytial and the ectodermal—is very conspicuous, and that for a long time it was owing to this difference in the appearance that the two layers were supposed to have a

different origin. It is only when the syncytial layer comes in contact with the contents of the intervillous space, and in pursuance of its object, a complicated not yet fully understood metabolism, that its appearance becomes different from that of the matrix (the ectodermal layer).—

But little need be added to the above description of the villi or villous epithelium of the first two to two and one-half months to make it fit their appearance from the third to the sixth month. Until the end of this period the villi continue to increase in length, and the picture of the later placenta is produced. On the whole, the villi, in spite of their growth, become thinner owing to the constant subdivision. The stroma assumes a more fibrous character. The vessels, which during the early stage of pregnancy do not exhibit a distinctly arterial structure within the villi, begin to have thicker walls. The epithelial covering toward the end of the sixth month diminishes in thickness and the nuclei become somewhat smaller and stain intensely. Many epithelial processes are still present, but they also are smaller; in a stained microscopic preparation (examined under low magnification) they appear as small particles of pigment on and between the villi.—The epithelial mass no longer contains Langhans' cells (no ectodermal layer). The thin, syncytial investment is apparently in direct contact with the stroma.—

Villi from the Third to the Sixth Month.

The villi from the sixth month to the end of pregnancy go through further changes in length, in the development of the blood-vessels and, by further ramification, in the calibre of the terminal branches, which become attenuated.—Before this period Langhans' ectodermal layer disappears; at this time the epithelial processes also disappear completely and the epithelial investment likewise becomes more attenuated and assumes a different appearance.—Whereas previously the covering of the villi was practically uniform, it becomes thinner, and often irregularly thin during the last months; in some places it is reduced to a minimum, and here and there it appears interrupted. As, however, it retains its marked tingibility, the deeply stained epithelial covering contrasts sharply with the paler, imperfectly stained stroma.—In microscopic preparations the picture often appears patchy on account of the varying thickness of the epithelial layer.

Villi from the Sixth Month to the End of Pregnancy.

By keeping in mind this picture of the chorionic villi, and the changes that take place at the various periods of pregnancy, it will be found easy to demonstrate under the microscope those portions of the fetal constituents which have a diagnostic value. The presence of fetal constituents indicates pregnancy, since villi, being fetal constituents (products of gestation), cannot exist without pregnancy.—

In addition to the above description there are to be mentioned certain changes of the fetal parts (villi), lest a failure to recognize these changes lead to an error in diagnosis.—They are the changes which are produced by the inclusion of villi in blood-clots, decidual masses and fibrin. The most important change consists in a loss of the syncytial covering (Fig. 90); enclosed in blood or blood-clots, it first undergoes granular degeneration and is finally absorbed. In places it may be preserved in the form of small patches; but as a rule the villi, which previously were easily recognized by the well-stained epithelial covering, remain within the coagula, fibrin or decidual masses, appearing as pale, translucent areas, in which some stroma-tissue can still be recognized, but which by their translucent character, as well as by the shape of the areas, suggest chorionic villi. One who is familiar with the picture will at once recognize the remains of the villi, hence the importance of becoming familiar with this villous alteration (Fig. 90).—The syncytial investment is occasionally retained in hydatid moles, in which chorionic villi, even when they are included in fibrin or decidua, may exhibit considerable proliferation of the epithelial covering (see below).

Villous Changes in the Blood-clot.

FIG. 90.—PLACENTAL REMAINS (after abortion): Villi enclosed in fibrin and blood, having lost their syncytial covering; the free villi with epithelial processes have retained their covering; the section also shows islands of decidual tissue. (2d to 3d month.) (Original.)

Having studied the above retrogressive processes in the syncytial investments, let us now consider the progressive processes in the epithelial covering—the above-mentioned epithelial proliferations in hydatid moles.—The processes which lead to the conversion of the villi into hydatid moles belong to the earliest period of gestation when the ovum is beginning to attach itself at the site of implantation. As a rule the entire ovum is affected; sometimes, however, small portions only of the fetal envelope undergo "hydatid" change, the surrounding parts remaining normal.—The cause of this metamorphosis is not known. The etiological connection with numerous lutein-cells in the ovary has never been demonstrated. There is much to disprove the theory, particularly in the case of completely circumscribed metamorphosis

Progressive Processes in the Epithelial Covering of the Villi.

of individual segments into hydatid mole (degeneratio hydatidosa circumscripta).—Macroscopically the hydatid mole is easily recognized by the grape-like structures of variable size; large and small cysts connected here and there by delicate strands of tissue forming a characteristic picture. Indeed a single cyst ("berry," "hydatid cyst") which has been discharged from the uterus is enough after a little practice to suggest the diagnosis to the examiner. Any one who has had his attention called to these structures cannot fail to recognize them. If a shapeless mass of blood-clots containing cysts (mola hydatidosa) is discharged, naked eye inspection may not suffice and a microscopic examination must be made. This very often shows the most

Hydatid Mole.

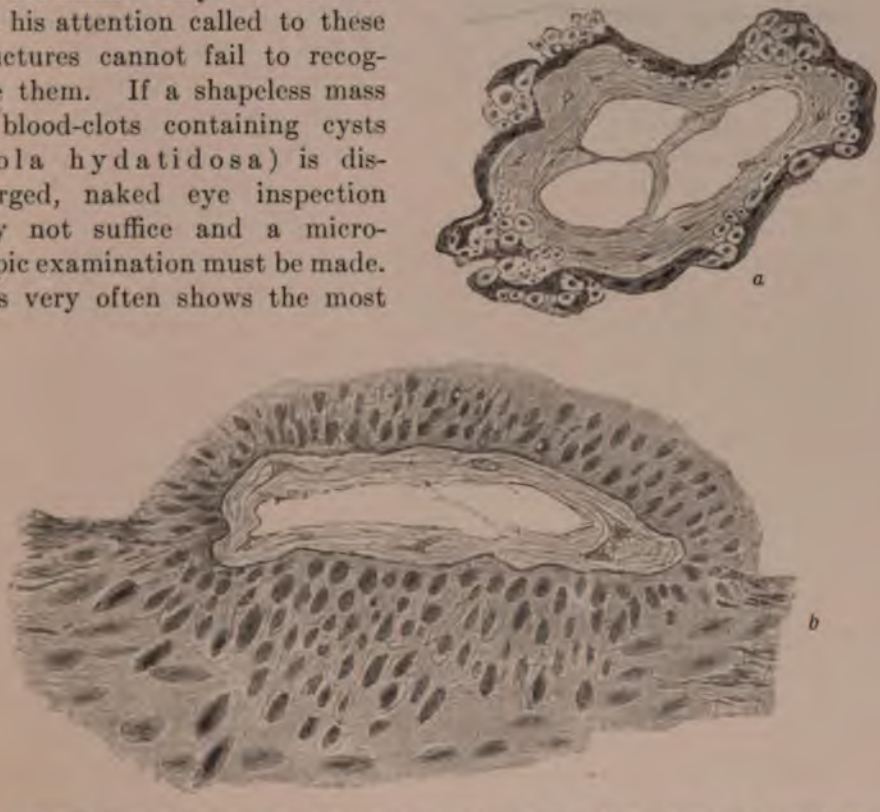

Fig. 91.—Villi of Hydatid Moles: *a*. Somewhat collapsed villus, with central softening proliferations of the syncytial and ectodermal (Langhans) cells. *b*. Hydatid mole—central liquefaction; the villus rests on the decidua basilaris; all around the villus, proliferation of the epithelial (fetal) investment, particularly well developed at the decidual junction; proliferation of the ectodermal cells and so-called syncytial wander-cells. (Original.)

interesting epithelial proliferative processes, which, as before mentioned, afford a key to the genesis of malignant forms (chorionepithelioma or syncytioma malignum).—It is difficult to decide whether the formation of hydatid mole is due to primary disease of the stroma or to primary disturbance of the epithelium; the former is more probable. The villous tissue presents irregular proliferations. Constrictions are produced in the form of delicate cords connecting the spherical enlargements which later become cystic. The

Hydatid Mole.

size of these connecting bands increases with their distance from the extremity of the villus. This type of proliferation points to a primary connective tissue origin.—In the proliferated, mucin-containing tissue softening and liquefaction occur at the centre, and a bunch of cysts may present first an epithelial covering, then a layer of connective tissue apparently embryonal, and central liquefaction; in the stroma which is still preserved at the periphery, as elsewhere, large round or stellate elements, with large nuclei and a relatively large quantity of intercellular substance, are found; neither the cell-bodies nor the nuclei take the stain well.—Differences are observed in the epithelial covering. In some cases there is an apparently normal syncytial layer overlying the ectodermal layer; at another place in the immediate vicinity there may be irregular proliferation of the epithelium—the cells of Langhans proliferate, apparently break through the syncytial layer, and continue to grow beyond it in places, so that the syncytium is found in the midst of the proliferated tissue as well as on the surface. Along with the proliferation of the cells of Langhans the syncytium apparently breaks up, in some cases, into large solitary elements (Fig. 91, *b*). A conspicuous feature in this proliferation are the large vacuoles often found side by side (Fig. 91, *a*).—These epithelial proliferations are sometimes very slight and at others completely surround the berries.—The descendants of the epitheluim may also proliferate into the stroma-tissue of the villi and are in that case regarded as forerunners of the existing or impending malignant syncytioma (Neumann).

Epithelial Proliferation in Hydatid Mole.

Softening of the Stroma.

Of the changes due to pregnancy in the maternal parts the most important from a diagnostic standpoint is the formation of the decidua.—At the beginning of gestation, and under its influence, the uterine mucosa is rapidly converted into the so-called membrana decidua, or briefly, decidua.—The change that is brought about in the uterine mucous membrane by gestation is recognized in the constituents of the mucosa: in the epithelial portions (surface and uterine glands) and in the stroma (in the stroma-cell). Under the influence of pregnancy the stroma-cell becomes the decidual cell.

Decidua Formation.

A. The effect of pregnancy on the epithelium is variable, depending on whether the surface or the glandular epithelium is affected, and it varies also in the different periods of pregnancy.—In the surface epithelium the change is merely a change of shape; the cylindrical, well-staining elements, with a centrally situated nucleus that also takes the stain well, become shorter, appear more cuboidal, the arrangement of the elements is somewhat more irregular, and the tingibility diminishes. As the uterus becomes greatly distended by the growing fetus, this change in the shape of the

Changes in the Epithelium: (*a*) On the Surface.

cells increases; with the enlargement of the uterine cavity and the accompanying enlargement of the uterine surface, the epithelium becomes shorter, almost flat, and directly attached to the surface like endothelium.—As a result of the adhesion which often occurs later between the decidua vera and the decidua reflexa, the surface epithelium disappears altogether. The surface epithelium is of no particular diagnostic importance.—The changes that take place during pregnancy in the uterine glands, on the other hand, depend chiefly on the period of pregnancy and are particularly important for the diagnosis of pregnancy in the first months. They may throw light upon the question whether or not an abortion has taken place.—The alteration of the uterine mucous membrane during the first months of pregnancy consists, in the first place, of an enormous increase in the thickness, which may be 1½ cm. and more. Macroscopically (see above) the mucous membrane presents an upper compact, and a deeper, spongy layer, while the microscopic picture resembles that of glandular endometritis; the uterine glands in the compact portion are compressed and thin, and represent the narrow ducts of the greatly dilated and closely aggregated glands in the deeper, spongy portion (Fig. 92). —The epithelium of the compressed, narrow excretory ducts is short, cuboidal and without special significance; in the spongy part, where the glands are greatly dilated and closely packed together, a most interesting change is often observed in the epithelium. While these changes are not pathognomonic of pregnancy they occur so often in that condition that they cannot be denied a certain diagnostic importance.

(b) In the Uterine Glands.

Fig. 92.—Decidua Vera: In the deeper layers the greatly hypertrophied glands are seen (Opitz-Gebhard's alteration). (Original.)

The glands are converted into Opitz-Gebhard glands. Both investigators, but more particularly Opitz, have pointed out these alterations. Whenever it is found in typical form, pregnancy must at least be thought of in connection with the etiology, and the diagnosis of pregnancy must be considered.—The conversion of the uterine

glands into Opitz-Gebhard glands consists in an interesting alteration of the epithelium and its structure (Fig. 93, *a*, *b*, *c*).—Instead of a simple, cylindrical epithelium, the glands present considerable proliferation of the epithelial cells; on the walls of the glands projections or ledges are formed, which in cross-sections look like papillæ, and around these ledges, or papilla-like projections, the epithelial cells are grouped in a somewhat loose arrangement. There results a palisade-like structure; the cells overlap one another and form several layers. In addition to this curious multiplication, this stratified arrangement of the cells with a loosening of their connections, certain other changes take place in the cells themselves. In the first place the shape becomes cuboidal or round; in the second place they take the various stains less readily than before. At first the alteration appears like an ordinary proliferative process; later, the picture suggests a beginning proliferation with desquamation and, finally, necrobiotic processes.

Transformation into Glands of Pregnancy (Opitz-Gebhard).

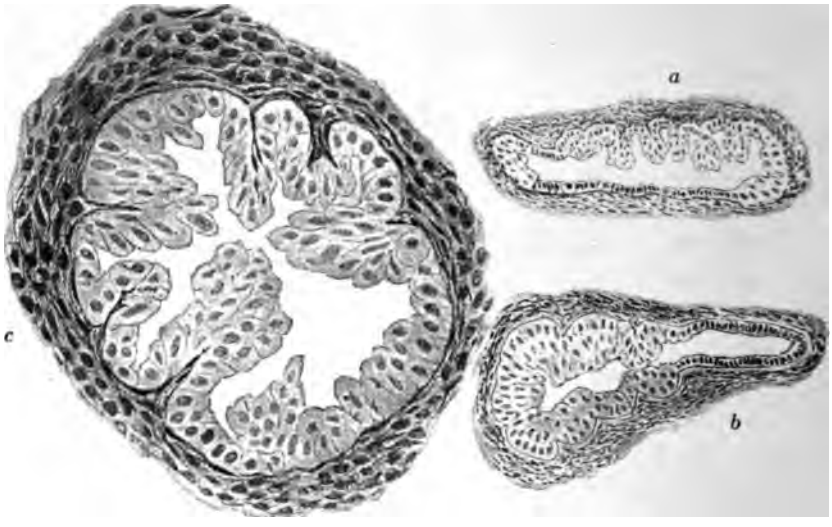

FIG. 93.—*a* and *b*. CIRCUMSCRIBED CHANGES OF THE GLANDS IN PREGNANCY: Part of the epithelial covering is unchanged; the other part shows Opitz-Gebhard's proliferation. *c*. Epithelial proliferation after Opitz-Gebhard under high magnification. (Original.)

There is no doubt that these peculiar processes may be in some way connected with pregnancy; the irritation which in inflammatory processes leads to the production of identical, or very similar formations may be exerted also by pregnancy.—Interesting as are these changes in the glands during pregnancy, they are not specific, and the glands cannot be described as "glands of pregnancy" in the strict sense of the term.—

During the later months of pregnancy the proliferation of the uterine mucous membrane (decidua vera) falls behind the enlargement

of the uterus (Figs. 94 and 95). The decidua vera is spread out and becomes thinner, and a distinction between a spongy and a compact portion is no longer possible with the unaided eye; in the microscopic preparation there are seen in the deeper layers cleft-shaped vacuoles which correspond to long-drawn-out uterine glands, while here and there the epithelial covering is still distinctly visible.—The Opitz-Gebhard glands have disappeared; they are still preserved in that portion of the birth canal which even in the 8th or 9th month has not yet become involved in the general dilatation of the uterine cavity (see below), and which, with the cervical canal, still exhibits the structure of a canal (Fig. 102). Here the uterine mucous membrane is not as yet spread out as in the body of the uterus, and therefore the Opitz-Gebhard glands, or so-called "glands of pregnancy," persist for some time longer; whereas, owing to their irregular, *i. e.*, relatively vigorous growth, they have disappeared from the upper layer.—As the entire birth canal, as far as the internal os, is utilized for the formation of the uterine cavity and for the reception of the fetus at the end of pregnancy—indeed as soon as the upper portion of the cervix becomes dilated toward the end of gestation (almost regularly in primiparæ, Olshausen)—the uterine mucous membrane of this portion also becomes so stretched that the true gland-formations disappear, leaving mere cleft-shaped spaces to represent the remains of the glands.—The epithelial changes in the uterine glands during pregnancy, in the form of the so-called glands of pregnancy (Opitz-Gebhard glands), in spite of the interesting pictures which they produce, possess only a relative diagnostic value during the first months (particularly in abortion); during the later months they have none.

Change in the Mucous Membrane during the Later Months of Pregnancy.

Fig. 94.—Uterine Mucous Membrane in the 9th month of pregnancy, taken from the middle of the body: greatly attenuated decidual layer; the muscularis is still covered with a layer of unaltered tissue (uterine mucous membrane); on the decidua are seen the fetal membranes (amnion and chorion). (Original.)

The changes produced by pregnancy in the uterine mucosa affect in the first place the epithelial constituents of the membrane (surface epithelium and glands) and have been discussed. The second change affects the stroma and is the most important for the diagnosis of pregnancy based on the maternal parts—Conversion of the stroma cells into the decidual cells.

Change in the Stroma-cell during Pregnancy.

B. The stroma cell of the uterine mucosa is a small round element in which the cell body cannot be recognized. There are also spindle-

shaped cells which are also almost completely filled by their nuclei. As has been stated, the mucous membrane, owing to the similar appearance of its elements, is usually described as a lymphadenoid, cytogenous tissue.—Under the influence of pregnancy the stroma-cell enlarges and becomes a large, delicate and finely granular element with indistinct outlines, round or approximately oval in shape, and containing a large nucleus (Fig. 96, *a*). The

Stroma-cell Becomes Decidual Cell.

FIG. 95.—UTERINE MUCOUS MEMBRANE IN THE 9TH MONTH OF PREGNANCY immediately above the internal os; in the deeper layers the uterine mucous membrane has not yet become altered (does not present the appearance of decidua), and the uterine glands are seen. (Original.)

tingibility of the nucleus particularly is diminished as compared with that of the simple stroma cell; hence the mucous membrane of pregnancy, which consists solely of decidual cells, is faintly stained and in the microscopic picture appears pale and translucent.—The spindle-shaped elements are converted into large spindle-shaped oval elements with more oval nuclei.—Subdivision of the membrane into layers of round, decidual cells and spindle-shaped elements is, however, somewhat forced and too diagrammatic.—

The supporting structure (intercellular substance) which accommodates the stroma-cells, or in pregnancy the decidual cells, under normal conditions consists of a finely granular material in which the decidual cells are embedded as in a soft mass.—The intercellular substance during pregnancy merits attentive examination because it sometimes becomes important in the differential diagnosis between membranous dysmenorrhea and pregnancy or decidual endometritis.—Pregnancy produces a decidual change in the greater portion of the mucous membrane, particularly in the upper portion; wherever the alteration takes place it is uniform: the cells are arranged side by side, separated by short intervals; the decidual cells are almost all of the same size, they occasionally have two nuclei without, however, being thereby altered in their general characteristics.—It is not possible to make a distinction between these decidual cells which surround the vessels and the more distantly situated cells; even in the earliest pictures of the mucosa in man the conversion of the uterine mucous membrane into decidua is everywhere uniform and quite independent of the vessels.—The greater portion of the uterine mucosa indicates a decidual change, *i.e.*, the uterine mucosa, which has been described above as divided macroscopically into a compact, and a spongy portion, shows the decidual change chiefly in the compact, upper portion. When the spongy portion is well developed, the stroma is not uniformly converted into decidual tissue in the deeper layers of the mucous membrane and around the glands; indeed the deepest layer, particularly in those cases in which the glands encroach somewhat on the muscularis, remains unchanged, or at least does not exhibit a characteristic decidual transformation. The glands

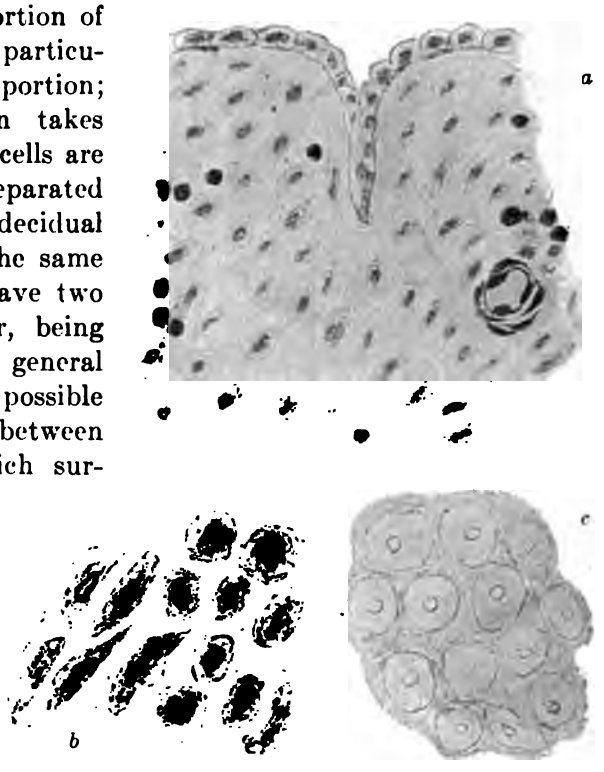

FIG. 96.—*a*. DECIDUA VERA (3d to 4th month); the stroma-cells are converted into large decidual cells; *b*. higher magnification; *c*. decidual cell (abortion) after death of fetus. (Original.)

During Pregnancy the Greater Portion of the Mucous Membrane Undergoes Uniform Decidual Transformation.

also and their epithelial cells do not take part in the alteration. An interesting condition is produced when only one part of the gland (the superficial part) shows epithelial change and is converted into half a gland of pregnancy (Figs. 93, *a*, *b*, and 102, *b*).—Such a finding is important for the decision whether or not the upper portion of the cervix becomes decidual during pregnancy (see below).—

The decidual cell is found in the mucous membrane (whether it be decidua vera, basilaris [serotina] or reflexa) during the entire duration of pregnancy, even though fatty degeneration of the cells may occur early in the reflexa, and even though the cellular elements almost disappear when, as occasionally happens, the decidua reflexa and decidua vera become fused.

The finely granular and indistinctly outlined decidual cells, which stain but indifferently, may undergo changes that are not without diagnostic importance, as, *e.g.*, the changes that take place after fetal death.—The outlines of the decidual cell become distinct; the finely granular, smoky protoplasm becomes transparent and almost like glass; the nucleus is smaller, round, and more sharply outlined (Fig. 96, *c*).

Change in the Decidual Cell after Death of the Fetus.

Whenever decidual cells are found, the diagnosis of pregnancy is assured—the diagnosis of pregnancy from maternal parts is based on the demonstration of decidual cells.

The diagnosis of pregnancy is made by the fetal elements (villi) and the maternal elements (decidua), or by both.—If, after abortion or premature labor, the fetal membranes have not been discharged, if the uterus still retains the remains of chorionic villi with the decidua basilaris, or decidua vera, the resulting symptoms may necessitate curettage or digital removal of the retained material.—In the remains of the abortion fetal and maternal elements can be demonstrated; conversely, if there is a doubt whether abortion has taken place, it will be cleared up by the demonstration of maternal and fetal elements.—Whenever the uterus still contains villi, some of the decidua is also preserved.—When there are remains of an abortion, or there are placental polypi, which are usually retained for some time in the uterus, the changes which demand attention are: (1) Those which occur in villi by their inclusion in fibrin or blood-clots; (2) those which occur in the decidual cells after fetal death (see above).—While it is an axiom that the presence of villi in the scrapings indicates the probable presence of decidual cells, the converse of this is not true. In exceptional cases, when the development of the decidua is quite marked, involution of the decidua—even in the absence of villi—may be delayed for some time, or the process of involution may lack uniformity; islands or decidual tissue of variable size may persist

The Diagnosis is Made by Fetal and Maternal Parts.

in the midst of the regenerated portions of the mucous membrane (Fig. 97). A most interesting picture is produced when the decidual islands consist only of a few cells and are distributed over large areas of the mucous membrane. In the main the decidual cells disappear rapidly when the uterus no longer contains fetal tissue.—

The decidual cell represents the stroma-cell of the uterine mucous membrane transformed by pregnancy; hence it is incorrect to speak of decidual cells in any other situation than the uterine mucosa. It is undeniable that in pregnancy greatly enlarged cells, resembling decidual cells, occasionally occur in various situations, as in the cervical tissue (Gebhard), in the vaginal portion, and in the entire extent of the uterus (underneath and on the peritoneum, Rob. Meyer).—

Fig. 97.—Islands of Decidual Tissue in the uterine mucosa, which is in process of regeneration, or completely regenerated.

As the name—decidua — indicates, the uterine mucosa, after the cessation of pregnancy and the removal of all the fetal parts, rapidly undergoes transformation; either it is expelled in the lochia in large or small pieces, or the cells regenerate and more or less perfectly regain their original state.—The large, finely granular cells become smaller; the nucleus also contracts by the excretion of a fine protoplasmic material, which remains for a short time among the nuclei and is then absorbed. The regeneration of the decidual cells takes place gradually and goes on slowly, until the microscopic picture is no longer characteristic, and, finally, the original stroma-cell reappears.—A gradual regeneration of the decidua—of the decidual cell—takes place.—While a positive diagnosis of pregnancy is based on the maternal and fetal tissues—the villi and the decidua—it should be mentioned also that the development of the blood-vessels in the decidua may suggest the probability of pregnancy. The capillaries which develop in the decidua of pregnancy are large and wide—at least their walls are formed only by endothelium, which is in contact with the decidual cells, in fact the decidual cells seem to form the vessel walls. Arteries or veins, except in the very early stages, are practically never demonstrable.

Thus large blood-vessels or blood-spaces, filled with blood, and in cases of abortion often thrombotic, also point to a change due to pregnancy and may assume importance in a differential diagnosis (from decidua membranacea).—

Difficulties in the Diagnosis of the Decidual Cells.

A diagnosis of pregnancy by the microscopic demonstration of the maternal tissues (decidua) seems very simple, yet many mistakes may be made, as the uterine mucosa presents a number of cell-changes which appear to be decidua but in reality have nothing to do with pregnancy. A familiarity with these changes is only acquired by practice, which will enable the examiner to recognize them at the decisive moment. The stroma-cell which has been transformed into a decidual cell under the influence of pregnancy is not in itself specific, it is merely suggestive of pregnancy. The small round, or spindle-shaped stroma-cell, which is usually completely filled by the nucleus so that no cell-body is recognizable, may be stimulated to further growth by irritants other than that of pregnancy. The inflammatory changes in glandular endometritis, especially the form which accompanies myomata and which must be designated endometritis interstitialis superficialis glandularis profunda, produce alterations of the stroma in the mucous membrane, which is endowed with great proliferative powers; the round, deeply staining nucleus of the stroma-cell becomes larger, more oval and less tingible, and the cell-body, which was not recognizable, becomes quite distinct; the protoplasm is finely granular, although the contour of the cell is quite distinct. Larger cells are easily mistaken for decidual cells, the more so as not only the single cell, but whole columns of cells are seen, so that large portions of the mucosa (often the entire upper layer) are occupied by the altered stroma-cells.—The important differential point is that in pregnancy the greater portion of the mucosa is characterized by a peculiar uniformity, the decidual cells being arranged in regular order side by side; the mucous membrane is more translucent in the microscopic picture. After the cessation of pregnancy, however, a change soon occurs in the decidua; retrogressive processes begin and a positive diagnosis becomes difficult; the great vascular dilatations, however, are not found in glandular endometritis (see above).—Here again, as is so often the case in the field of microscopic diagnosis, a final decision will be reached by the coöperation of clinician and pathologist.—In addition to the changes which take place in the stroma-cells in glandular endometritis and which lead to confusion with decidual tissue, we have a similar transformation occasionally in membranous dysmenorrhea. The importance to the gynecologist of escaping the error of diagnosing pregnancy in a

Inflammatory Irritants Produce Changes in the Stroma Resembling Decidual Tissue.

Stroma-cell in Membranous Dysmenorrhea.

virgin suffering from membranous dysmenorrhea needs no comment. The ordinary microscopic picture of membranous dysmenorrhea, which is commonly seen, does not give rise to confusion: the small round cells of the stroma are widely separated and apparently compressed by the intervening exudate, the glands have a crumpled appearance (Gebhard) and are narrow. Even if in the deeper layers of the membrane the round cells of the stroma are enlarged and both nucleus and cell-body are distinctly recognizable, yet the unequal size and more fibrillar character of the intercellular substance suffice to guard against diagnostic errors (Fig. 98, *a*). But there are cases of membranous dysmenorrhea in which the enlarged stroma-cell, in the microscopic picture, so closely resembles the decidual cell that a diagnosis of pregnancy may easily be

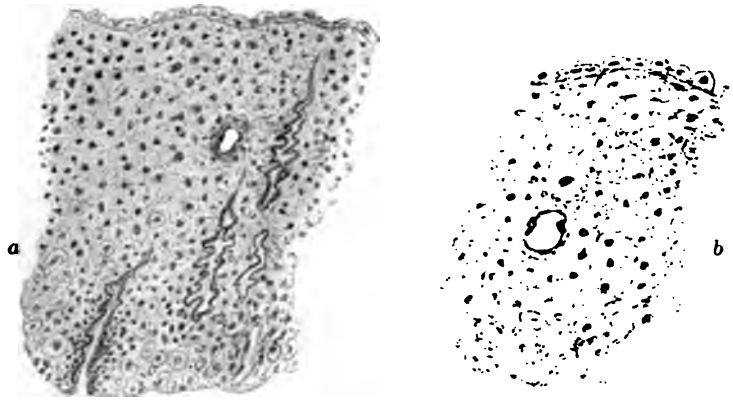

FIG. 98.—*a*. MEMBRANOUS DYSMENORRHEA, WITH CRUMPLED (GEBHARD) GLANDS: Interstitial exudative endometritis. *b*. Membranous dysmenorrhea with greatly enlarged stroma-cells showing decidual change. (Original.)

made (Fig. 98, *b*; compare with the microscopic diagnosis of endometritis). By the most careful and thorough examination, taking into consideration all the factors—the nature of the vessels; that of the intercellular substance and also of the glands, although the latter are less important; the entirely different pictures seen in other portions of the mucous membrane and also by subjecting the suspected material to macroscopic scrutiny—a definite judgment may finally be reached. An examination of this kind is often exceedingly difficult because on it depends the decision of delicate questions; fortunately cases of this kind are rare.

Although the irritation of pregnancy has certain peculiarities and regularly produces changes of very great extent, the irritation is nevertheless not specific. Other irritants may produce cells resembling decidual cells; other irritants may produce changes in the epithelium exactly like the Opitz-Gebhard glands, although it should be emphasized once

more that the epithelial changes in the uterine mucosa incident to pregnancy by no means possess the same significance as the transformation of the stroma-cell into the decidual cell.—Elements resembling decidual cells occur also in the absence of gestation; Opitz-Gebhard's glands are seen in the non-pregnant state.—The transformation of the stroma-cell, the small round elements entirely filled by its nucleus, into large cells resembling decidual cells under the influence of pathologic irritants or inflammatory affections, has led to serious errors; this simple, although interesting, transformation has been mistaken for sarcomatous degeneration. A failure to interpret correctly the physiologic or pathologic cell-changes may lead to the adoption of incorrect methods of treatment. Points of importance in the differential diagnosis are that in the changes of pregnancy the cellular (decidual) transformation affects the greater portion of the mucous membrane uniformly, while a pathologic transformation is usually confined to the upper portion of the mucosa. In sarcoma, however, a more accurate examination brings to light the atypical nature of the cells (larger and smaller elements) and the difference in the nuclei, which also take the stain more intensely; in rare instances the differential diagnosis between membranous dysmenorrhea and physiologic and pathologic changes (between pregnancy and endometritic alterations) may be exceedingly difficult.

Other Irritants Produce Changes in the Stroma and in the Epithelium which Resemble those of Pregnancy.

Fig. 99.—Decidua Vera, showing inflammatory infiltration (round-cell infiltration).

In connection with the microscopic diagnosis of pregnancy by the maternal tissues, *i.e.*, the decidual cells, it is important that the examiner should be familiar with the change which is sometimes produced in the decidua by an inflammatory affection—the picture of so-called decidual endometritis (Fig. 99), which appears in various forms. In the acute variety there is marked, small-celled, inflammation infiltration of the mucous membrane; in many portions the small round cells are closely packed; in microscopic sections they are usually intensely stained, contrasting with the decidual cells and their delicate, somewhat smoky cell bodies and faintly staining nuclei. They escape observation altogether in a casual inspection of the microscopic preparation, and the diagnosis of interstitial endometritis during pregnancy is missed. Again, the proliferation of the decidual tissue may produce polypoid excrescences on the surface, or bridge-like proliferations of the mucous membrane may be formed—the decidua may be converted into a decidua tuberosa or polyposa. Micro-

Decidual Endometritis.

(a) Interstitial.

scopic examination will guard against the danger of overlooking this alteration, which is due to pregnancy: in this condition also a cellular multiplication takes place.—Finally, there is a more "chronic" form of alteration—if it be permissible to use such a word in connection with a condition of such comparatively short duration as pregnancy. The decidua, which usually represents a delicate covering of the placenta (decidua basilaris), or a delicate, soft, spongy, mucous membrane, is rigid, and the basilar portion is converted into a thick, slightly undulating, yellowish layer suggesting convolutions. This is due to changes in the interstitial tissue, the intercellular tissue of the mucous membrane; the decidual cells often appear smaller, are widely separated and forced apart by the increased intercellular substance. This change is usually the result of a previously existing interstitial endometritis. Owing to the nutritive disturbances, particularly in the decidua basilaris, which it brings on, this alteration is important in the diagnosis of

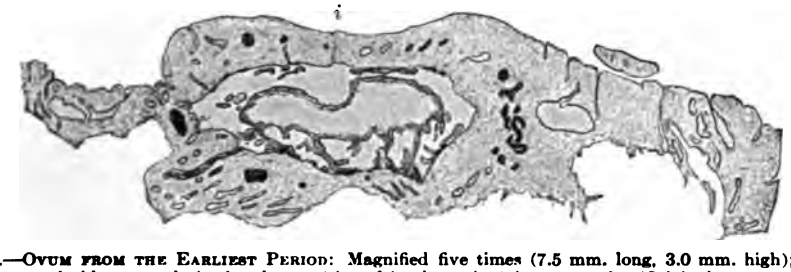

FIG. 100.—OVUM FROM THE EARLIEST PERIOD: Magnified five times (7.5 mm. long, 3.0 mm. high); in the decidua capsularis the closure (site of implantation) is seen at *i*. (Original.)

the cause of abortion. Not infrequently these alterations are especially well marked in the decidua basilaris: large strands of connective tissue may be seen—the cellular elements are wanting over comparatively large areas, or they may be increased in number by chorion-cells; the vessels appear in part thrombotic; here and there fatty degeneration, or even calcareous deposition, is observed; large masses of fibrin (fibrin-plugs) are present. Villi, enclosed in fibrin and enveloped in decidual and chorion-cells, may be demonstrated. All these inflammatory changes combine to produce a condition which may be designated **cirrhotic decidua** (vera, basilaris).

In the interstitial inflammatory changes the epithelial constituents mostly play a minor part. In addition to the latter, there are also changes in the glandular apparatus—in fact we may speak of a glandular decidual endometritis: the glandular layer, and with it the entire thickness of the mucous membrane, is hypertrophied (proliferated), and the latter may measure as much as 1½ cm. (*b*) Glandular.

In microscopic preparations the Opitz-Gebhard glands are so densely packed that the appearance of malignant degeneration—malignant

adenoma — is produced. The picture of a fungous and greatly hypertrophied mucous membrane is also seen.—

Most important for the microscopic diagnosis, especially in the distinction between benign and malignant syncytioma, is a thorough acquaintance with the decidua basilaris. The appearance during the early months of pregnancy, and during the last months are best described separately.—During the first months the decidua basilaris—in comparison with the decidua vera (see above)—is irregular and hilly; the villi are attached everywhere and dip down into the superficial depressions. There is still a sufficient interval between the villi so that one can see between them; whereas at the end of pregnancy the villi (of the basilaris) are so closely packed that this is no longer possible. In the decidua basilaris, as in the decidua vera, there are still found well-marked glands in the deeper layers, so that in the beginning a spongy layer can be recognized even with the unaided eye.—During the last months this plainly visible glandular layer disappears, and only the clefts corresponding to the glands are seen in microscopic preparations, besides blood-vessels. During the early months there is nothing to be seen of the strip of fibrin which later, to a greater or less extent, occupies the superficial layer of the basilaris (Nitabuch).—In addition to the large, delicate decidual cells, other peculiar cells are very often found in the basilaris. They are large, often resembling the decidual cells, and traverse the basilaris from above downward either singly or in larger aggregations;—they may extend as far as the muscularis, or even beyond the boundary and push their way in between the muscle cells.—These cells are usually distinguished by their nuclei, which are often very large and sometimes shapeless, taking the stain well: the cells in question are so-called syncytial wandering cells, *i.e.*, fetal parts derived from the covering of the villi. The presence of these syncytial elements is the result of the attachment of the villi to the basilaris and of the increase of the chorionic elements; the syncytial elements grow into the latter (Fig. 101; compare also Fig. 91).—The attachment of the ovum to the basilaris is effected by means of the villi in a variety of different ways. Until recently it was generally believed that the originally naked ovum, provided only with small, bud-like projections which later grew into villi, attached itself to the decidua or lodged in a fold of the greatly hypertrophied mucous membrane; and that the decidua then continued to proliferate until it completely surrounded the ovum (capsularis) and united above the ovum, shutting off the latter (ovum-space) from the uterine cavity. In fact during the early stage of attachment, when the bed of the ovum is from 1 to 1½ cm. wide, the remains of the line of closure can be seen in microscopic sections (Fig.

Decidua Basilaris.

(*a*) During the First Months.

Chorion Cells in the Decidua.

Attachment of Ovum.

100, at *i*). As the ovum grows and the villi proliferate, the mucous membrane envelope of the capsularis becomes larger—the ovum, according to this theory, lies in a cavity lined with mucous membrane.—According to the most recent view (Spee in the guinea-pig, Hubert Peters in man), the ovum while still small passes through the epithelium of the uterine surface and becomes embedded in the mucous membrane; the villi grow into the surrounding tissue, which becomes transformed, softened and filled with blood. Hence the ovum is lodged in the mucous membrane itself and not in a cavity lined with mucous membrane. The fissure which is seen in the microscopic preparation and which was

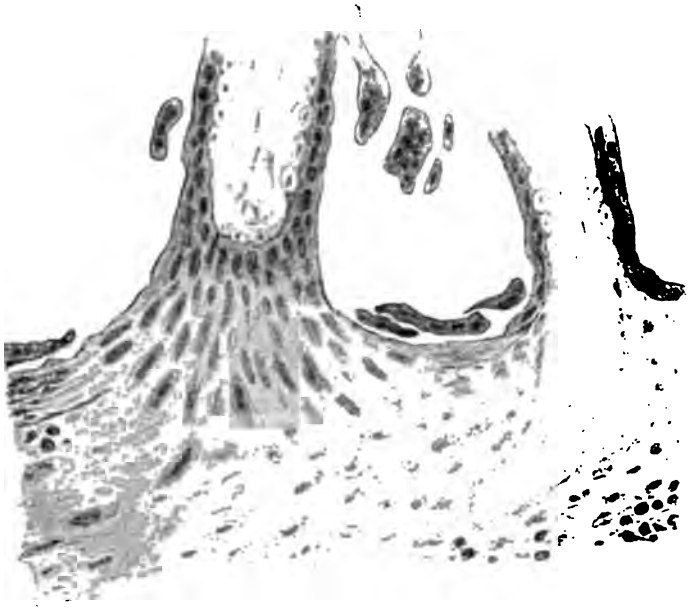

FIG. 101.—VILLUS from the fourth to the fifth week, attached to the decidua basilaris by a cell-column. Breaking up of the syncytial and ectodermal covering, syncytial epithelial processes, alongside of which are seen villi penetrating the decidual basilaris; loss of the covering (attaching-villi). (Original.)

formerly regarded as the remains of the closure, marks the point where the ovum has dipped down through the mucous membrane (site of implantation).—The proliferating villi, which at first uniformly surround the small ovum, become loosely attached to the surrounding tissue; later the villi which are destined to form the placenta (basilaris) develop in greater numbers at these points.—The attachment of the villi as seen in the basilaris during the early months may be a simple process of agglutination—the villus is merely applied to the surface; or the villus may penetrate the basilaris, leaving its epithelial covering behind on the surface of the basilaris; or, finally, the villus may not come in direct contact with the mucous membrane and become attached to it by a prolongation of the hood-like

Various Modes of Villous Attachment.

epithelial covering, which is converted into a "cell-column" (Fig. 101 [villus to the left]).—This cell-column, which consists of syncytial constituents and ectodermal cells, instead of merely attaching itself to the surface, quite often shows a peculiar, spreading formation of its cellular elements (chorion-cells) growing into the basilaris. The syncytium apparently breaks up into large, syncytial elements ("syncytial" wander cells); the ectodermal cells multiply and fill the tissue in all directions and, as they frequently enlarge at the same time, it may at last be difficult to distinguish them from the maternal cells (decidual cells) that are present. In other words, the attachment of the villi by cell-columns is occasionally accompanied by an infiltration of the maternal tissue with fetal elements.

Infiltration of the Decidua with Chorion-cells.

—A similar infiltration of the maternal tissue with ectodermosyncytial (chorionepithelial) elements may take place from each villus instead of from the cell-columns.—Epithelial proliferation may also occur in the villi that become attached to the surface, without the epithelial cells invading the maternal tissue.—The proliferation of the villous epithelium is most interesting. It occurs (1) in the growing villus during the early months, (2) in hydatid moles, and (3) during the attachment of the villi to the basilaris, and in the latter condition the chorionepithelial elements may, in addition, greatly infiltrate the maternal parts. If the infiltration (invasion) is very great, the suspicion of a malignant process may be aroused; under the influence of powerful irritants of unknown origin (in myoma with pregnancy, Rob. Meyer) an extensive and very severe infiltration of this kind with fetal elements takes place in the decidua and muscularis, and an inexperienced observer is very apt to make a mistaken diagnosis of malignant chorionepithelioma.—Whether the giant-cells in the basilaris (serotina), which were described long ago, are merely derivatives of the epithelial covering of the villi, or whether non-epithelial structures of this kind occur in the basilaris also, is difficult to decide. It has at least been definitely observed that most giant-cells are derived from chorion-cells; they may represent large giant-cells with large, shapeless, well-staining nuclei, or giant-cells with numerous pale nuclei that do not stain well. During the later months the attachment of the villi is apparently more simple; besides simple agglutination of the villi with the surface—either the tip or part of the villous surface attaching itself to the mucous membrane—a number of them penetrate directly into the tissue, often to a considerable depth, either vertically or approximately parallel to the surface (attaching-villi); these have no epithelium and are easily distinguished from the decidual maternal tissue by their stroma and paler, more translucent tissue (Fig. 101, villus to right).—In specimens in which the fetal vessels have been injected with some pigmented material, small

vessels given off by the villi and entering the decidua may be seen. During the later months the so-called 'septa' of the placenta in the decidua serotina demand attention: flat, columnar projections of decidual tissue of varying thickness—forming 'septa'—penetrate the placenta as far as the place where the chorionic villi originate; the villi attach themselves to the septa also.—

In addition to the attachment of the villi to the basilaris, mention must be made of the villous proliferations in the vessels (veins), which occur almost regularly to a limited degree; under pathologic conditions the villi may proliferate far beyond the decidua and enter the maternal tissues (compare Fig. 86, *c*). In hydatid moles altered villi are seen in the vessels beyond the uterine muscularis.—The villi invade the basilar veins from the intervillous space and erode the vessels, which have no special walls of their own; the villi then follow the blood-stream.—According to the observations of some authors (Bumm, Hofmeier), small arterial vessels empty their contents into the intervillous space: and in this way—hand in hand with the veins, which often contain villi—an intervillous circulation is established in the human placenta.—(A detailed description of the intervillous space and the intervillous circulation, a description of the method of attachment of the ovum, of the changes in the uterus and its mucous membrane after expulsion of the fetus, and of the development of the cavity of the ovum during pregnancy must be sought elsewhere).—

As has been previously stated, the microscopic diagnosis of pregnancy is based on the demonstration of the changes incident to pregnancy and of the products of gestation—on the demonstration of maternal and fetal tissue, the decidual cells and the chorionic villi.—The decidual cell is the small, round stroma-cell of the mucosa of the uterine body altered by the irritation of pregnancy; and although cells exhibiting decidual changes and resembling these cells occur occasionally under special circumstances, the above statement is nevertheless in the main correct.—It has never been proven that there is a regular, constantly occurring transformation of the elements in any other situation but the mucous membrane of the body of the uterus, excepting the occasional occurrence in the mucous membrane of the tubes in the immediate vicinity of the ovum (see above).—The doctrine of the transformation of the cervix and its mucous membrane into decidual tissue, likewise that the upper portion of the cervix undergoes decidual change and is converted into a dilatation of the uterine cavity in order to accommodate the growing ovum, is false; while it is true that the cervix occasionally becomes dilated and takes

The Microscopic Diagnosis is Based on the Demonstration of the Decidual Cells and the Chorionic Villi.

Regular Decidual Transformation Takes Place Only in the Corporeal Mucosa, Never in that of the Cervix.

part in the formation of the cavity for the reception of the ovum, it is nevertheless always preserved as a cervix and recognizable as such. —Whereas, on the theory of the transformation of the cervix into decidual tissue, the exact location of the internal os cannot be positively demonstrated under the microscope, since the originally well-defined boundary between the cervical and the uterine epithelium becomes blurred by the transformation, it can on the contrary be demonstrated that the internal os is a fixed, immovable point. The proof of this is furnished by the fact that the mucous membrane, which becomes greatly swollen and transformed into decidual tissue during pregnancy, remains unchanged in the deepest layers, that is, the part in contact with the muscularis (Fig. 102);—in this situation the characteristic uterine glands can always be demonstrated. There are no cervical glands, which, if present, ought surely to be demonstrable in this deepest layer of the mucosa, if it were derived from the upper portion of the cervix. In the gravid, as well as in the non-gravid uterus the internal os is situated at the boundary line between uterine and cervical epithelium and glands; it is not necessary to distinguish between a histologic and an anatomic internal os. The decidual cell is the transformed stroma-cell of the corporeal mucosa. The demonstration of this fact—that the internal os is a fixed point—that no regular, constant decidual transformation takes place in the cervix—supplies a firm foundation for the anatomical doctrine of the lower uterine segment, located between the internal os and the point of cervical attachment. During the expulsion of the fetus this portion occasionally becomes considerably distended (drawn out in the longitudinal axis of the uterus), whereas the cervix takes part only to a very limited degree in this longitudinal distention,

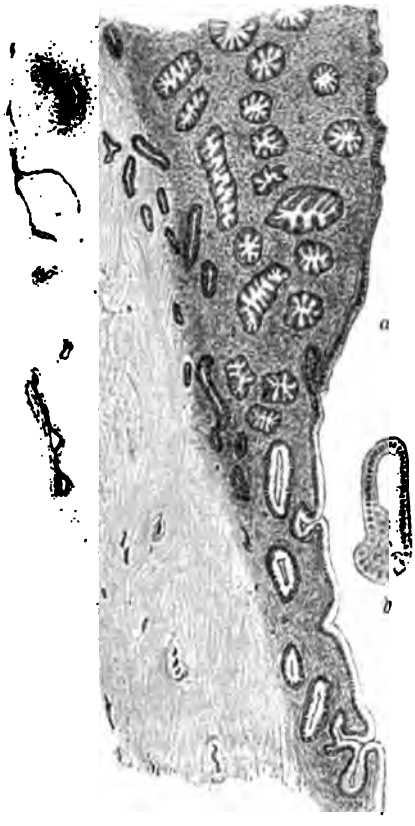

FIG. 102.—*a*. Position of the internal os (O.i.) between the fourth and the fifth months of pregnancy; sharply defined boundary between cervical and corporeal mucous membrane. The latter shows two layers; immediately beneath the surface the mucosa exhibits decidual change, the deeper layer (in contact with, and in part penetrating the muscularis) consists of unaltered uterine mucous membrane with unaltered uterine glands. *b*. Beginning Opitz-Gebhard change in a uterine gland, which lies close to the muscularis. (Original.)

The Cervix Remains, Persists as a Cervix.

and instead undergoes principally a transverse distention, *i.e.*, "dilatation."—By means of a microscopic examination it is possible: (1) to decide the question whether pregnancy exists; (2) to refute the doctrine of cervical transformation; (3) to explain the doctrine of the lower uterine segment; and at the same time to prove (4) that the question in regard to the internal os is not decided by the attachment of the ovum to the uterine mucous membrane, which is entirely a matter of accident; but that (5) the junction of the cervical and uterine epithelium alone determines the position of the internal os.

Microscopic Diagnosis of the Membranes Expelled from the Genitalia, Especially from the Uterus.

(Fibrin-Membranes, Dysmenorrheic Membranes, Decidua Graviditatis.)

Examination of the material expelled from the genitalia, especially from the uterus, consists in distinguishing between the material actually expelled and material said to be expelled, which is occasionally given the physician for examination. The findings of the latter, while extremely interesting, will not be included in the present description.—The correct interpretation of material actually expelled from the genitalia may be of the greatest importance in individual cases; an error in diagnosis may harm the patient and damage the physician's reputation.—The prognosis depends on the correct interpretation.—To make a diagnosis of pregnancy, *e.g.*, in the case of membranous dysmenorrhea in a virgin, may be fraught with the most serious consequences. The gravest errors in treatment may result if a benign condition is mistaken for malignancy, or degenerated myomatous material for villi.—As has been repeatedly emphasized, the material received for examination must first be subjected to careful macroscopic scrutiny. In many cases an experienced gynecologist will be able to make a diagnosis without any further examination, although even the expert may fail to interpret the condition from the macroscopic appearance alone, or may actually be led to make an erroneous diagnosis.—Microscopic examination is necessary both for the purpose of controlling a previously formed opinion and of confirming the diagnosis. — Depending on its character, material expelled from the genitalia, especially from the uterus, must be worked up in various ways. Fluid material may require chemical, bacteriologic or microscopic treatment, depending upon whether one expects to find albumin or mucin, tubercle bacilli or cocci (gonococci), or minute tissue elements suspended in the fluid.

Macroscopic Inspection.

Microscopic Examination.

(a) Fluids.

The question to be decided may be purely legal: are gonococci, spermatozoa, or particles of tumor present?—In other cases a portion of solid material may be submitted for examination.—For the examination of fluids cover-slip preparation may suffice, or the fluid may require centrifugation in order to obtain cellular material. Dry preparations may have to be made (see above, Microscopic Examination).—Semi-solid material, of which we shall here consider only the membranous structures expelled from the uterus, may be divided into two large groups: organized membranes expelled from the genitalia, especially from the uterus, and unorganized matters.

(*b*) Solid Material.

Organized and Unorganized Parts.

Of the unorganized membranes expelled from the genitalia the most important are those consisting of fibrin, the expulsion of which is often attended with violent pain. Macroscopically they may closely resemble organized mucous membrane; under the microscope we find a network of fibrin of variable thickness, made up of fine fibres and small meshes, and containing numerous colorless blood-corpuscles, mucus-cells and epithelia, which at the first glance are very apt to give the impression of organized tissue. So-called 'canalised fibrin' strongly suggests in its composition preparations of bone and bone-corpuscles with their radiating Haversian canals.—Next to the fibrin membranes we have blood-clots, which are also held together by fibrin, and depending on their age, the changes produced in them by the action of fluids in their immediate neighborhood, and also owing to their laminated arrangement, are often difficult to diagnose macroscopically. If the blood is the result of a slow and scanty hemorrhage, especially hemorrhage into fluid, the coagula may present such a striking resemblance to chorionic villi or to a beginning hydatid mole, that a strict observance of the rule to resort to the microscopic confirmation is the only certain means of protection against diagnostic errors. Coagulated masses of mucus, of gelatinous consistency, owing to the large round cells embedded within them, assume the most bizarre shapes by distortion, frequently resembling large sarcoma cells or even syncytial elements, and may give rise to error. Immersion in alcohol causes these masses to shrink and harden and, after they have been cut in sections, stained and washed in water, they again become glairy and gelatinous.

(*a*) Unorganized.

Artefacts. Blood-clots Mistaken for Villi.

The most important among the organized membranes expelled from the uterus are the dysmenorrheic membranes, the discharge of which is often attended with intense pain and in some cases continues with great regularity for years, the external appearance usually remaining practically unchanged. In other cases they make their appearance unexpectedly at longer or shorter inter-

(*b*) Organized.

vals. The membrane which is expelled in membranous dysmenorrhea is also called decidua menstrualis, a term which is based on an old erroneous conception and, as it is likely to lead to error, will not be used in this place.—With regard to the anatomical structure and microscopic composition, great differences are to be noted. In the main, however, it may be said that the majority of observers agree with regard to the anatomical and microscopic picture, that the typical features are only exceptionally obscured, and the diagnosis therefore is difficult only in exceptional cases.—The dysmenorrheic membranes represent portions of the uterine mucous membrane of varying size, indeed the entire upper portion of the uterine mucosa may be expelled. In these large pieces, eliminated *in toto* from the uterus, it is occasionally possible to recognize distinctly the region of the tubal orifices and that of the internal os. The thin, delicate membranes are usually of uniform tenuity and pale in color; they possess a smooth surface, corresponding to that of the uterus, and a slightly villous, rough surface, corresponding to the line of separation, or avulsion, from the uterine mucous membrane (which remains behind).—In membranes that are expelled *in toto* the part corresponding to the reflexion from the posterior to the anterior wall is especially thin.—The histologic composition of dysmenorrheic membranes corresponds to the picture of interstitial exudative endometritis; the small spheroidal stroma-cells are forced apart by the exudate; the latter appears in the preparation as a finely granular, dust-like, often transparent mass; the small round cells of the stroma, however, are crowded apart and appear small and compressed.—In many preparations the framework of the intercellular substance is quite conspicuous.—The glands are somewhat obscured in the microscopic picture; their epithelium also appears smaller, and the glands, instead of being straight (rectilinear), are compressed, showing zigzag forms or, to use Gebhard's expression, crumpled.—The tingibility is diminished and, as the exudate itself does not take the stain, the membranes appear in the picture only moderately well stained.—This picture, which is frequently seen and may be said to be the most common picture of dysmenorrheic membranes, is occasionally modified by complication with inflammatory affections of the mucous membrane and with hemorrhage; the stroma-cells are increased in number and accordingly more densely packed, the glands showing proliferation, so that the [above described] picture of glandular paucity and crumpled appearance of the glands is not seen; instead, the picture of endometritis interstitialis exudativa glandularis hæmorrhagica is produced.—The rough external surface shows, in the microscopic picture, glands which

Dysmenorrheic Membranes.

Dysmenorrheic Membranes Present the Picture of Interstitial Exudative Endometritis.

are often almost completely isolated from their surroundings, and portions of stroma that are forced apart, but nowhere the expected picture of an inflammatory layer (reaction-zone). The microscopic picture supports the view that the membranes are mechanically separated by the exudative swelling which takes place in them, the separation being attended by painful contraction of the uterus. A very interesting and noteworthy condition is presented by the stroma-cells in the deep layers, near the line of separation; whereas the stroma-cell of the uterine mucous membrane is usually spherical or oval, and completely filled by its nucleus, certain deviations from this typical picture are occasionally seen. The stroma-cells in the deep layers of the membrane are larger than usual; in some of the cells the protoplasm is visible and the nucleus is distinctly seen within a round or oval cell.—The size of the cells varies; they are not closely aggregated and are surrounded by round cells which are completely filled by their nuclei; these enlarged and altered cells, which are found in the deep layers near the line of separation, often resemble small decidual cells.—

Stroma-cells Larger in the Deep Layers.

The above-described condition may be regarded as the most common in dysmenorrheic membranes; *i.e.*, the membrane is organized and presents the picture of interstitial exudative stroma alteration.—The cells in the deep layers particularly occasionally resemble decidual cells.—Preparations are also encountered which, even to the unaided eye, present by their greater thickness and grayish-brown appearance certain deviations from the usual picture of dysmenorrheic membranes. In the microscopic picture the stroma-cells in or near the deep layers, or throughout the entire membrane up to the surface epithelium, are converted into large elements with cell bodies and nuclei. It is very easy to fall into the error of attributing this change to pregnancy.—In such cases even the experienced examiner finds it difficult to pick out the points of importance for a differential diagnosis.—The stroma-cells no longer merely resemble decidual cells but have actually assumed the character of decidual elements.—It is true that in the decidua vera, which represents an alteration due to pregnancy, the cells are of uniform size, particularly those in adjoining portions of the membrane, while in dysmenorrheic membranes there is apt to be some variation in size.—The intercellular substance in the mucosa of pregnancy is more finely granular, often quite homogeneous, like a soft mass in which the cells lie embedded as though they had been pressed in; while in the dysmenorrheic membranes the intercellular substance is more fibrous, and made up of delicate fibrils.—The blood-vessels in the decidua are distended with blood, and lined with endothelium only, whereas in

Stroma-cells Resemble Decidual Cells and Eventually Assume the Character of Decidual Cells.

the non-gravid state the mucosa shows thick-walled and usually rather narrow vessels. It is evident from what has been said that in individual cases the differential diagnosis between pathologic conditions (dysmenorrheic membranes) and changes due to pregnancy may be exceedingly difficult.—It is interesting to note that there are, in addition to the irritation of pregnancy, other etiologic factors that are capable of producing decidual changes.—

In addition to the dysmenorrheic membranes, true decidual membranes are also expelled: the microscopic examination and the macroscopic appearance of the decidua have already been described (see above). The demonstration of the decidual character of the membrane in itself suffices to establish a diagnosis of pregnancy; but it does not determine its seat, since decidual tissue is formed in the uterus in both intra-uterine and extra-uterine pregnancy. Histologic differences between the decidua of intra-uterine and that of extra-uterine pregnancy have been described: it is said that in extra-uterine pregnancy, in accordance with the lesser enlargement of the uterus, the decidual cells are smaller, the decidua as a whole thicker, and the glands less numerous. But the differences are not sufficiently characteristic, and the material submitted for examination is often too scanty for a thorough study, being just enough for a diagnosis of pregnancy.—If chorionic villi are found among the membranous portions, it is a proof that the ovum is situated within the uterus.

Decidual Membrane.

Occasionally cystic structures of varying size are discharged along with the membranous material, and also sometimes without it, but always accompanied by hemorrhage. The macroscopic appearance of the cysts suggests hydatid mole, and the provisional diagnosis is usually confirmed by the microscope.

Discharge of Cystic Structures.

Occasionally material consisting of thick, membranous shreds of tissue, often tubular in shape or of irregular outline, is submitted to the examiner as having been expelled from the genitalia. Sometimes it is possible with the unaided eye to identify such material as coming from the vagina by the partially preserved columna rugarum; while microscopic examination, which is often quite difficult on account of the gangrenous change in the material, taken together with the macroscopic appearance, establishes the diagnosis of exfoliative vaginitis (particularly after some grave disease).—After severe cauterization (chlorid of zinc) large portions of the uterine mucosa and muscular layer are expelled. With the aid of the microscope the origin of these membranous masses of varying thickness may be determined. But often without previous cauterization large "membranous" pieces may be discharged after parturition

Exfoliative Vaginitis and Endometritis.

(metritis exfoliativa), and here again the microscope must decide as to the origin of the suspected material.

Besides these firm, compact masses, delicate, whitish, thin membranes, made up of stratified squamous vaginal epithelium, are observed. Along with the squamous epithelium the tips of the papillæ are seen in these structures (Fig. 103), which represent the exfoliated superficial laver, and often almost the entire vaginal mucous membrane. The causes of this condition are cauterization, irritation with, or local application of, liquor ferri chloridi, chlorid of zinc, or alum.

Membrane Consisting of Vaginal Epithelium.

Morbid products from the bladder are sometimes expelled from the genitalia in the shape of small, membranous particles and, owing to the marked proliferation of the surface epithelium, may be mistaken

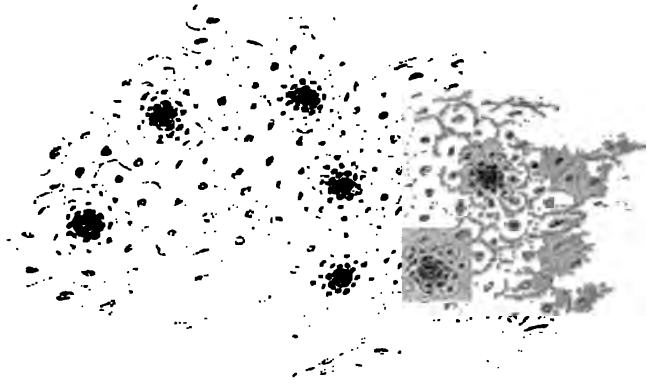

FIG. 103.—VAGINAL MEMBRANE: Vaginal epithelium with the tips of papillæ. (Original.)

for carcinoma; but, before a diagnosis of carcinoma can be made, it must be demonstrated that the epithelium has slowly crept into the stroma; although it is quite true that papillary fibromata of the bladder may possess very little connective tissue. (Compare microscopic diagnosis of polypi and particles of tissue obtained from the uterus.) —Mycelium from the vagina (Oidium albicans) is usually expelled in the form of membranous shreds mixed with squamous epithelium.

It appears, therefore, that from the genitalia, and from the uterus in particular, unorganized and organized products of gestation, alterations due to pregnancy, and benign and malignant masses may be expelled.—In most cases the nature of the material expelled can be positively determined by microscopic examination, or the microscope confirms the diagnosis based on naked-eye inspection. The question whether the suspected material is malignant—whether it is carcinoma, sarcoma, or chorionic epithelioma—cannot in most cases be decided without the microscope.

Displacements of the Uterus and Adjacent Organs.

The normal uterus is movable within wide limits. Under the influence of abdominal pressure, and when the adjacent organs are full, the uterus may alter its position; but it returns to its normal position as soon as the cause has been removed, provided the peritoneum and its reinforcing ligaments and the pelvic connective tissue possess their normal elasticity: these are physiologic displacements. In contradistinction to physiologic, we designate as pathologic displacements those which are permanent. The causes of these permanent displacements reside in conditions which permanently affect the uterus. Of course, even these displacements may correct themselves, and the uterus may return to its normal position, if the permanent cause is removed; thus, *e.g.*, a uterus which has been displaced forward by an ovarian tumor in Douglas' space may return to its normal position if the tumor is removed.

Definitions.

Displacements of the uterus also involve the tubes, ovaries and vagina; in addition, the adjacent organs, bladder and rectum, also suffer a change of position. As the position of the uterus usually constitutes the characteristic feature of the clinical picture, displacements are classified according to the position of the uterus, as follows:

1. Positions. Displacement in which the uterus, while retaining its normal curve, varies its position in relation to the pelvis. Taking the pelvic axis as a basis, we speak of anteposition (anterior position—"the uterus is forward") when the entire uterus is displaced forward; retroposition, when the dislocation is backward; and lateroposition, when the organ is displaced to one side of the pelvic axis. In the same manner the uterus may be displaced upward in the pelvic axis, elevation; and downward, descent or prolapse of the uterus.

Position.

2. Versions are changes in the position of the uterus in which the body deviates to one side of the pelvis and the cervix to the other; in this condition the uterus rotates around a pivotal point situated in the upper portion of the cervix, where it is held fast by the pelvic connective tissue. The version is designated with reference to the normal position of the uterus, and we accordingly speak of anteversion, when the body is displaced forward on the bladder; retroversion, when it turns over backward; and lateroversion, when it inclines to one side. In this anomaly the uterus is usually drawn out, elongated.

Version.

3. Flexion indicates a displacement of the uterine body with reference to the cervix and implies a change in the cervico-corporeal angle. We speak of anteflexion when the angle is much more acute than in the normal uterus, and of retroflexion when the body is turned over backwards so that the angle presents posteriorly. Lateroflexion is exceedingly rare because the uterus does not readily bend in this way, and most apparent lateroflexions are really anteflexions or retroflexions combined with torsion.

Flexion.

4. Torsion or rotation of the uterus around its long axis.

Torsion.

5. Inversion indicates an invagination of the uterine wall into the uterine cavity.

Inversion.

6. Hernia is a displacement of the uterus into a hernial sac. So far inguinal and crural herniæ of the uterus are the only ones that have been described.

Hernia.

The diagnosis of these displacements must include, besides the determination of the position of the uterus and adjacent organs, the causes of the dislocation. Most displacements are secondary and due to causes acting on the uterus from without. These causes in most cases are much more important from a pathologic standpoint than the displacement itself: thus, *e.g.*, dextroposition of the uterus is in itself an entirely indifferent affection, while its cause, right-sided parametritis with adhesions, or a left-sided intraligamentary tumor, is the real source of the symptoms. This is particularly true of malpositions and versions of the uterus, whereas prolapse and the various forms of flexion are in themselves of considerable pathologic importance.

Anteposition of the Uterus.

The entire uterus is crowded forward: the vaginal portion is immediately behind the symphysis at its normal level opposite the lower border of the bone; the fundus is felt immediately behind the abdominal walls, and sometimes the adnexa in immediate connection with it; the vaginal vault is also displaced forward, so that the vagina runs upward behind the symphysis (Fig. 79). Not infrequently the greatly distended bladder is found immediately behind (underneath) the abdominal walls in anteposition of the uterus, because evacuation of the urine is interfered with by compression of the urethra or of the floor of the bladder.

Palpatory Findings.

The most frequent cause of anteposition of the uterus is a retro-uterine tumor which, in order to gain room for its development, has displaced the uterus forward. Such are tumors of the ovary and tube occupying Douglas' space. The most advanced form of anteposition occurs with large retro-uterine hematoma or serous or purulent pelvic exudates; the uterus is often so close to the

Causes.

anterior wall of the exudate that it cannot be palpated with certainty. More rarely the uterus is displaced forward by traction and fixed by adhesions; *e.g.*, a hematoma or exudate in the vesico-uterine excavation may become inspissated, with the formation of adhesions that draw the uterus forward and produce permanent union with the peritoneum of the anterior abdominal wall. The cicatricial tissue resulting from parametrial lacerations or exudates also draws the cervix, and with it the body of the uterus, forward. Combinations with lateroposition occur when the tumor occupies a lateral position, or traction is exerted forward and to one side—with elevation, when the tumor develops underneath the uterus and pushes it upward.

The diagnosis of this form of displacement may be difficult when the uterus cannot be felt with the external hand, and particularly when it cannot be differentiated from retro-uterine tumors by palpation. By making the most of the internal fingers and pushing the anterior vaginal wall upward, enough of the anterior wall of the cervix and body of the uterus may be felt to justify the assumption that the entire uterus is forward. If the bladder is distended it must be evacuated in order to make it possible to demonstrate the uterus in its forward position.

Diagnosis.

Retroposition of the Uterus.

In retroposition of the uterus the vaginal portion is posterior, while the external os is directed downward and somewhat forward; the body of the uterus is in the hollow of the sacrum immediately in front of the anterior sacral wall, with the fundus directly under the promontory; the normal curve is preserved (Fig. 104).

Palpatory Findings.

In retroposition, more than in any other displacement, the anomaly itself is of no significance whatever, while the causes of the displacement are entirely responsible for the symptoms. Occasionally retroposition is present in the recumbent position due to relaxation of the ligaments, permitting the uterus to fall backward; this of course has no pathologic significance. It must be borne in mind also that the retroposition may be due to a distended bladder, which sometimes cannot be discovered by palpation. The most frequent cause of retroposition is inflammation behind the uterus with adhesions. The inflammation may be in Douglas' space and may represent the remains of an evacuated, perforated or inspissated hematocele or pelveoperitonitic abscess, which, in the recent stage, cause anterior displacement of the uterus and, as the inflammatory tissue contracts, draw the uterus backward and produce a retroposition; or—what is unquestionably a more frequent cause—inflammatory adhesions are formed in the parametrium, particularly in the

Causes.

two folds of Douglas and, by displacing the upper cervical segment backward and upward, produce a combination of retroposition, anteflexion and elevation. A rare cause is found in tumors situated in front of the uterus, lifting the uterine body from the bladder and crowding the entire viscus backward; they are usually ovarian tumors, easily movable pus-tubes and, occasionally, hematomata or exudates in the peritoneum or in the antecervical connective tissue.

Combinations of retroposition and laterodisplacement are very frequent, when the contraction takes place in one of the folds of Douglas

FIG. 104.—RETROPOSITION OF THE UTERUS FROM POSTERIOR PARAMETRITIS. P.-F. ½. (Original.)

and draws the uterus toward that side; with retroversion, when the contraction acts chiefly from behind on the body of the uterus, the vaginal portion turning forward and the os being directed backward and a little downward.

The diagnosis is easy, provided it is possible to feel the uterus at all. The posterior position of the vaginal portion at the pelvic wall, with the os directed downward, is in itself distinctive, and may establish the diagnosis if the abdominal walls are so thick that the uterus, which lies posteriorly and deep in the pelvis, cannot be reached. If the anterior vaginal vault is pushed up as far as possible and it can

be demonstrated that the uterus is flexed on its anterior wall, the diagnosis can be made with the internal hand alone. Not infrequently general anesthesia is required for the diagnosis of this displacement. Retroposition is very frequently confounded with retroflexion because the two terms are used indiscriminately, and practitioners are in the habit of regarding every uterus that cannot be felt in front as a retroflexed uterus (see p. 246).

Diagnosis.

The diagnosis of the cause is more important. Posterior fixation is readily recognized by drawing the uterus forward with both hands, or with one hand only through the posterior vaginal vault; if the procedure is accompanied by pain, the cause must be sought in an inflammatory condition. The distinction between posterior perimetritis

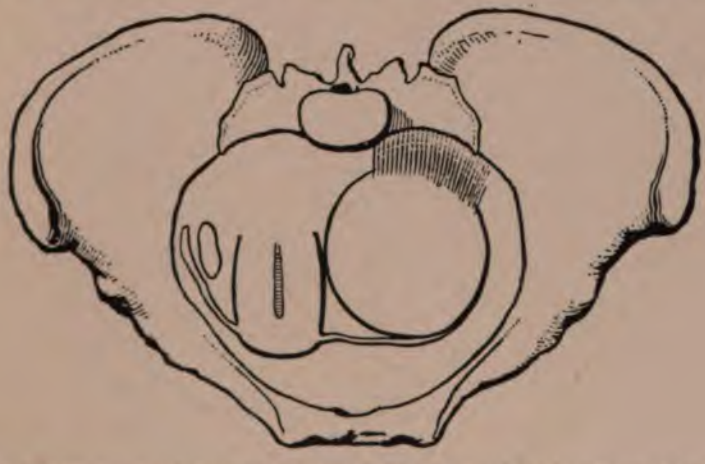

FIG. 105.—DEXTROPOSITION OF THE UTERUS DUE TO A LEFT-SIDED INTRALIGAMENTARY OVARIAN TUMOR. P.-F. ⅓. (Original.) Cystic ovarian tumor, the size of an apple, in the left broad ligament, attached to the pelvic wall by adhesions posteriorly and on the left side. The uterus is completely displaced into the right half of the pelvis.

and parametritis is also quite easy. If the body of the uterus is covered with adhesions and fixed at the point where it is covered with peritoneum, the cause is perimetritis; if, on the contrary, the external hand readily passes down behind the uterus into Douglas' space without feeling any adhesions, while the attempt to push up the posterior vault of the vagina at once meets with the resistance of resilient tissue or inflammatory bands, the cause is a parametritis.

Lateroposition of the Uterus (Dextroposition, Sinistroposition).

The uterus is displaced to the lateral wall of the pelvis and retains its normal flexion. The body lies on the bladder or occupies a partially erect position; the vaginal vault on the side toward which the uterus is displaced is narrowed to a mere slit by the vaginal portion, while on the other side the vault is well developed. The adnexa between

the uterus and the pelvic wall are difficult to palpate, while on the other side they are drawn into the middle of the pelvis (Fig. 106).

Lateroposition in rare cases is due to congenital shortening of the broad ligament. Among acquired causes tumors of the adnexa, developing laterally between the uterus and the pelvic wall, play a prominent part. If the tumors are pedunculated they do not greatly affect the position of the uterus, and occupy Douglas' space or emerge from the pelvis as they grow. On the other hand, adherent tumors of the tube and ovary, especially intraligamentary tumors, must crowd the uterus to one side in order to gain the necessary space for their development (Fig. 105). Typical cases of lateroposition are found with intraligamentary hematomata and exu-

Causes.

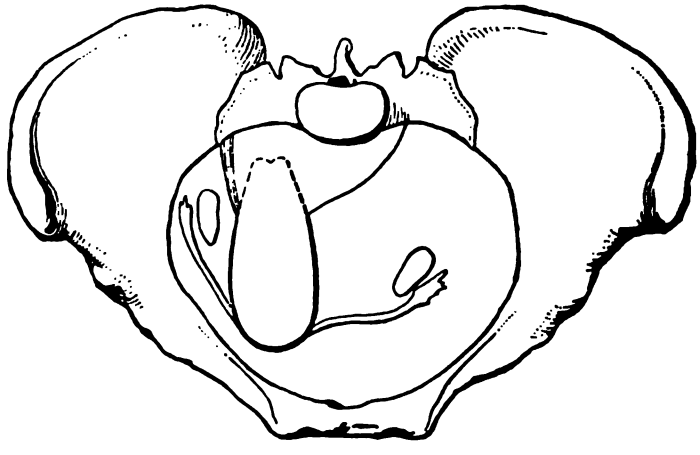

FIG. 106.—DEXTROPOSITION OF THE UTERUS FROM RIGHT-SIDED PARAMETRITIS WITH ADHESIONS. P.-F. ⅓. (Original.) The uterus is entirely within the right half of the pelvis, fixed by the inflamed and contracted right fold of Douglas. The left adnexa are drawn into the middle of the pelvis.

dates. When the tumor occupies the upper portion of the broad ligament it merely displaces the uterus to one side, and lateroversion results; when it is in the vaginal vault, a slight degree of elevation is often associated with the lateral displacement. In cases of bilateral intraligamentary tumors the uterus is caught between the two and forced upward. Another cause of laterodisplacement is found in chronic inflammation resulting in adhesions which contract and draw the uterus to the pelvic wall. The original exudate may have been intraligamentary, or may have occupied the upper portion of the pelvic connective tissue; or Douglas' folds on one side may contract, in which case the uterus also suffers a slight backward displacement (Fig. 106). In this way a recent intraligamentary exudate may cause displacement of the uterus to one side and, after absorption has taken place, draw the viscus through the middle of the pelvis to the opposite

wall. Inflammatory processes resulting in adhesion are less common in the peritoneum and in the adnexa.

Slight grades of lateroposition are usually overlooked. They are most readily recognized by marking the median line with the internal hand, introduced in approximately the same manner as for measuring the diagonal conjugate, and determining the relative position of the uterus. In this way it may be recognized that the lateral aspect of the uterus projects beyond the median line into the

Diagnosis.

FIG. 107.—ELEVATION OF THE UTERUS FROM FIXATION OF THE ORGAN AFTER CÆSARIAN SECTION. P.-F. ⅓. (Original.)

other half of the pelvis, and that mobility in one direction is diminished. If the lateroposition is due to a large tumor, palpation of the uterus may be quite difficult. Lateral fixation is recognized as the cause of lateroposition by attempting to bring the uterus into the median line, using both hands, and noting the elastic resistance encountered and the pain elicited by the manipulation.

Elevation of the Uterus.

In elevation of the uterus the organ is lifted out of the pelvis in the direction of the pelvic axis and brought slightly nearer the anterior abdominal wall. The vaginal portion may be found above the

upper margin of the symphysis, while the fundus, even when the uterus is not enlarged, may rise almost to the navel. The uterus may rise spontaneously if it becomes so much enlarged that it no longer finds room in the pelvis (pregnancy, myomata). This form of elevation can be determined only by finding the vaginal portion at a higher level than normal and cannot be deduced from the level of the fundus.

Palpatory Findings.

The causes of elevation are usually external to the uterus—commonly a tumor which has developed underneath the uterus and pushed it upward, such as hematocolpos, large carcinomata and sarcomata of the vagina, large submucous uterine myomata and tumors of the recto-vaginal septum, that have been expelled into the vagina. Tumors situated in Douglas' space produce anteposition as well as elevation. Much more rarely the uterus is drawn out of the pelvis by tumors attached to it by pedicles, such as ovarian tumors, or by adhesions attached to the anterior abdominal wall. Such adhesions give rise to pronounced elevation only when they have been formed at a time when the uterus was high up and in contact with the anterior abdominal wall, *i.e.*, during pregnancy, parturition or the puerperium. Adhesions of this kind form after Cæsarian section or result from pyosalpinx during the puerperium. They do not really elevate the uterus, but merely hold the organ fast in its high position and prevent it from sinking back into the pelvis during involution. Elevation of the uterus in addition results from artificial fixation, as in ventrofixation, myomotomies, securing ovarian stumps with sutures, and the like (Fig. 107).

Causes.

The diagnosis of elevation is easy and presents difficulties only when the vaginal portion is so high as to be out of reach, or the uterus is so firmly adherent to tumors that its outlines cannot be determined.

Diagnosis.

Prolapse.

Prolapse is the time-honored term for downward displacement of the uterus and includes a number of anomalous positions of the uterus, vagina and adjacent organs that are etiologically quite different and represent entirely distinct clinical pictures. The physician must, therefore, never content himself with a diagnosis of "prolapse." He must include in his diagnosis the changes present in all the organs that take part in the prolapse. For this purpose systematic examination of the vulva, with the floor of the perineum, and of the pelvis, the vagina, uterus, bladder and rectum is necessary.

Definition.

The various forms of complete prolapse represent the final stages of gradually developing changes, and are usually very much alike. Most cases of prolapse, however, that come under the physician's observation

are incomplete, or still in the process of development, and differ in certain important points, until they finally reach the terminal stage which is practically the same in all forms. As, however, the process may become arrested at any stage, it is not proper to base a diagnosis exclusively on the terminal conditions; the transitional stages must also be described as separate and distinct clinical pictures, bearing in mind, however, that the transition to the final stage is often quite rapid. Thus one woman may suffer from moderate descent of the vagina and continue in the same condition until the end of her life, while in another patient a moderate degree of descent of the vagina (partial prolapse) may within a few months become converted into complete prolapse of the vagina. Similar changes occur in the uterus. For this reason I have subdivided the various clinical pictures which are included under the generic term "prolapse."

The various stages of development afford a good opportunity for investigating the mode of prolapse, and as several distinct therapeutic principles are based on the genesis of the condition, certain etiologic factors must be included in the diagnosis. Thus, treatment is materially influenced by the question whether a prolapse of the uterus is primary or secondary.

I employ the term descent for displacement of the vagina or uterus down to the plane of the vulva; prolapse when the parts descend below the vulva; and by inversion I mean invagination of the vagina from above through the cervix.

The position of the patient is extremely important in making a diagnosis of prolapse. Theoretically the erect posture is the best, because under the influence of abdominal pressure the displacement of the organs is found in the exact condition that produces the symptoms as the woman pursues her daily occupation. In the recumbent position minor grades of prolapse disappear, while the more pronounced forms become considerably smaller, and only a complete prolapse remains practically unchanged. But as examination in the standing posture is hardly decent, and bimanual palpation and the use of the sound are impossible, it is best to examine for prolapse on the examining-chair; having the patient bear down or drawing the prolapsed structure as far out of the vulva as possible with forceps or fingers. In some cases, however, it is well to examine afterwards in the standing position in order to determine the degree of displacement present.

Position of the Woman During the Examination.

The examination should be begun with inspection of the vulva. In minor grades of descent of the vagina and uterus the closure of the vulva is still almost complete; but on bearing down, the labia separate and the prolapsed parts come into view. In severer grades the vulva

gapes to a degree corresponding to the volume of the prolapsed parts. In such cases the width of the introitus can only be determined by replacing the prolapse. Scars or perineal tears are very frequently, although not constantly present; even when the peritoneum is intact it appears greatly shortened and compressed by the prolapse, but the frenulum and fossa navicularis can still be brought out. Perineal lacerations of medium grade which have obliterated the

Vulva.

FIG. 108.—ANTERIOR AND POSTERIOR DESCENT OF THE VAGINA, WITH DESCENT OF THE UTERUS. P.-F. ⅓. (Original.) Both vaginal walls protrude as far as the introitus; moderate cystocele; small rectocele. Uterus somewhat prolapsed. The transverse line in these illustrations of prolapse indicates the plane of the vulva.

fossa navicularis, so that the skin of the peritoneum merges directly with the prolapsed posterior vaginal wall, are the most common. In the rare cases of prolapse in nulliparæ the shortened remains of the greatly separated hymeneal folds are seen at the introitus. The anus and the internal orifice of the urethra must also be inspected, because prolapse of the urethra and of the rectal mucous membrane is very often associated with prolapse of the vagina. Umbilical, inguinal and femoral herniæ are also fairly common.

The vagina takes part in all varieties of prolapse, and the following conditions may be distinguished:

Descent of Both Vaginal Walls.—In most cases both vaginal walls protrude into the introitus as the woman bears down, the anterior usually more than the posterior (Fig. 108); circular descent of the vaginal wall is rare. The relaxed posterior columna rugarum is very often obliquely placed because one side has been torn away by a vaginal laceration and the columna is drawn over to the other side by the force of its own elasticity.

Descent of Anterior and Posterior Vaginal Walls.

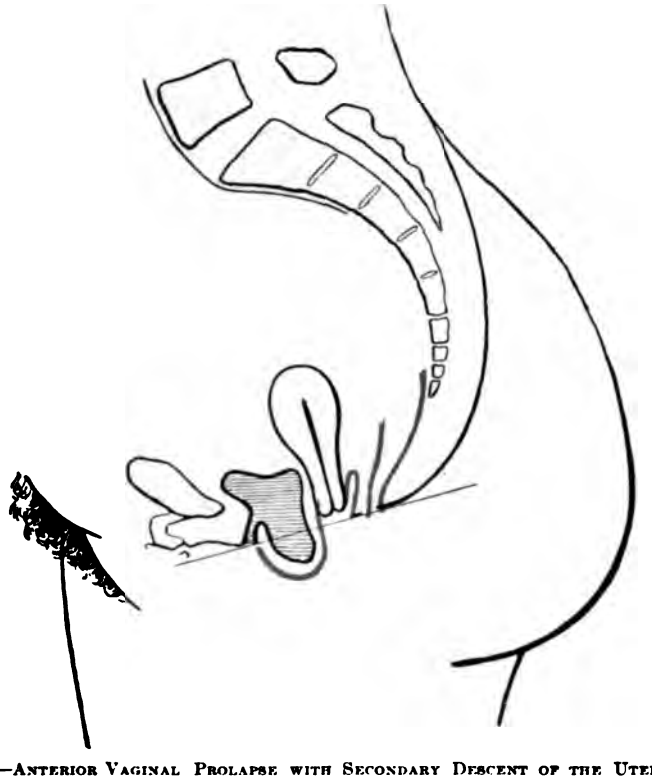

FIG. 109.—ANTERIOR VAGINAL PROLAPSE WITH SECONDARY DESCENT OF THE UTERUS. P.-F. ⅓. (Original.) The anterior vaginal wall is ballooned out in front of the vulva, and contains a large cystocele drawing the uterus down; the posterior vaginal wall is inverted above, *in situ* below; no rectocele.

Prolapse of the anterior vaginal wall causes a tumor of variable size in front of the vulva, consisting of the prolapsed anterior vaginal wall. The lateral portions of the vagina are drawn down somewhat by the tumor; the posterior vaginal wall in complicated cases, so far as its lower portions are concerned, remains completely *in situ*, while the posterior vaginal vault is inverted by the uterus, which also descends. A cystocele is always present and varies in size with the degree of vaginal prolapse (Fig. 109).

Prolapse of Anterior Vaginal Wall.

Prolapse of the posterior vaginal wall is one of the rarest forms. The upper third of the vagina, as far as its attachment with the peritoneum of Douglas' space, may be pushed down from above, while

the lower half remains in its normal position. This form of prolapse is most frequently observed in cases of great ascites; the uniform pressure of the fluid slowly forces the posterior vaginal wall downward until it appears in the vulva. In a similar manner this portion of the vaginal wall may be protruded by the pressure of coils of intestine occupying Douglas' space (posterior vaginal enterocele). In rare cases of infantile development congeni-

Prolapse of Posterior Vaginal Wall.

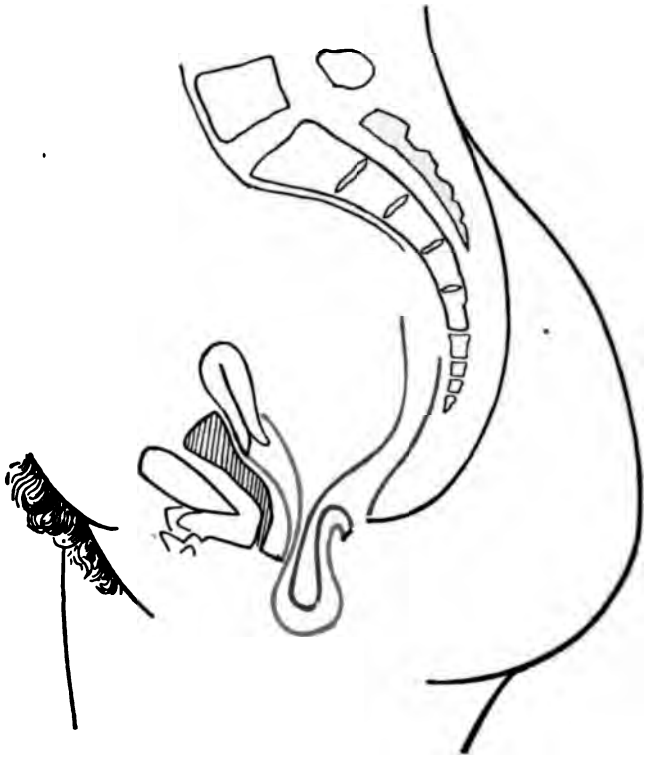

FIG. 110.—PRIMARY ISOLATED PROLAPSE OF THE POSTERIOR VAGINAL WALL WITH LARGE RECTOCELE. P.-F. ⅓. (Original.) The senile uterus, also the anterior vaginal wall, occupies the normal level. The posterior vaginal wall forms a large pouch in front of the vulva and contains an extensive rectocele.

tal abnormal depth of Douglas' pouch is the cause of the descent of the posterior vaginal vault. Prolapse of the posterior vaginal wall usually affects the lower half of the structure, which protrudes into the vulva like a flabby pouch or transverse fold, or sometimes like a globular tumor, and often can be drawn down a considerable distance below the vulvar plane. The lateral portions of the vaginal wall usually take part to some extent in the prolapse, while the anterior vaginal wall remains completely *in situ*. Rectocele, or protrusion of the anterior rectal wall, is regularly present in cases of marked prolapse; perineal tears are frequently, but not always present (Fig. 110).

In prolapse of the entire vagina the latter is entirely in front of the vulva (Fig. 112), and the reflexion of the mucous membrane is therefore seen in the form of a complete circle immediately behind the introitus. Posteriorly the fossa navicularis, which belongs to the vestibule, of course remains *in situ;* the appearance of this fossa often gives the impression that the posterior vaginal wall is not completely prolapsed, but the mucous membrane is easily recognized as belonging to the vestibule by the absence of wrinkles

Total Prolapse of Vagina.

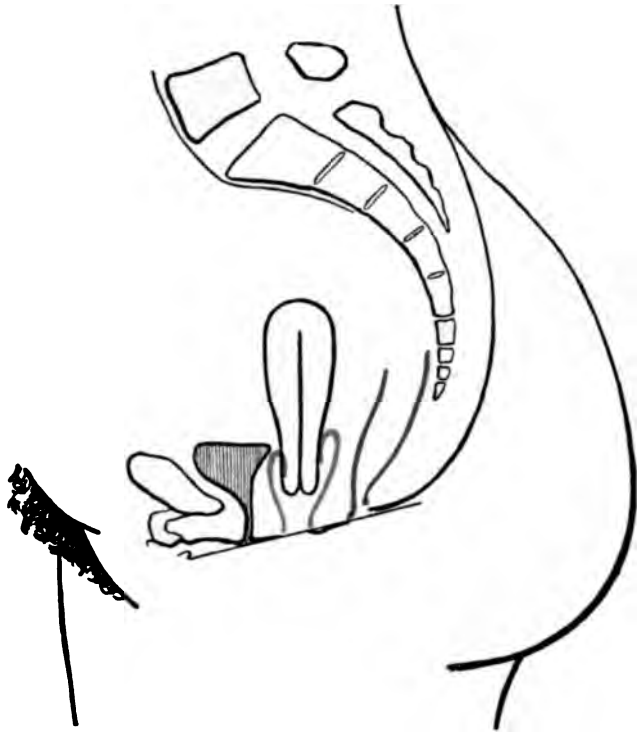

FIG 111.—PRIMARY DESCENT OF THE UTERUS WITH INVERSION OF THE VAGINA. P.-F. ⅓. (Original.) Retroverted and prolapsed uterus, 7 cm. The introitus is contracted. The vagina below *in situ* and above, inverted.

and folds (rugæ). Occasionally the prolapsed vagina may present irregular retractions produced by bands of scar-tissue connecting such points with the pelvic wall and fixing this portion of the vagina. In this manner fixation of the cervix may occasionally keep up the entire vaginal vault, while the lower portions lie in front of the vulva in complete prolapse.

Inversion of the vagina, in contradistinction to prolapse of the vagina in which the lowest portions are always first to be displaced, is a circular invagination of the vagina beginning at the vaginal vault and, in its subsequent development, successively causing downward displacement of the lower portions of the canal (Fig. 111). Inversion

is the result of a primary descent of the uterus; if the uterus drops from above it carries with it the vaginal vault, while the lower portions of the vagina either remain completely *in situ* or merely suffer slight relaxation. In severer grades of uterine prolapse the vagina becomes shorter and shorter, until the vaginal portion appears in the introitus. When the vagina is completely inverted it often lies in front of the vulva in the same way as in total primary prolapse. Combinations of inversion and descent of the vagina are frequently encountered; the lower portions are relaxed and prolapsed, while the vaginal vault is somewhat depressed and invaginated. The intermediate parts may at first remain unchanged.

Inversion of the Vagina.

The parts of the vagina that are prolapsed in front of the vulva and no longer covered by the mucous membrane of the introitus and of the labia majora, lose their character of mucous membrane, become dry and horny and assume the appearance of skin. Owing to the absence of sebaceous glands they lose their softness and elasticity, and the surface becomes fissured and covered with crusts. Occasionally pigmentation takes place.

Secondary Changes in the Vagina.

As a result of external irritation decubital ulcers may develop on all the prolapsed parts, particularly the vaginal portion of the cervix. The ulcers are usually circular, sometimes irregular in outline or stellate, with a sharply defined, somewhat infiltrated border and no tendency to cicatrization. The floor of the ulcers is usually covered with a yellow exudate; they are soft and therefore readily distinguished from carcinoma. Constriction of the prolapsed parts of the introitus may produce edematous swelling of the mucous membrane, which becomes thick and glistening, and its wrinkles occasionally stand out in heavy ridges. In cases of chronic prolapse this leads to the development of hypertrophic conditions of the entire vagina.

Diagnosis of the displacements of the vagina. The labia majora are separated and the patient is asked to bear down with moderate force; this is followed by protrusion into the introitus of a tumor of variable size, which is recognized as vaginal mucous membrane by its transverse folds. Whether it consists of one or both walls is determined by the position of the lumen of the vagina, which forms a transverse cleft, and the merging of the prolapse with the anterior, or the posterior commissure. The initial stages of prolapse of the vagina, which consist merely in relaxation and loosening of its attachments to neighboring structures, are recognized in the anterior vaginal wall by the fact that it yields more readily to the pressure of the finger; in the posterior, by its greater mobility and looser attachment to the rectum, and the ease with which it can be picked up in folds. A beginning inversion is recognized by

Diagnosis of Displacements of the Vagina.

the descent of the vaginal vault. If the vagina lies entirely in front of the vulva, it may be difficult to decide between prolapse and inversion; as a rule a hint is obtained from the fact that in inversion only so much of the vagina is outside of the vulva as has been carried down by the cervix, *i.e.*, as much as is necessary for covering the cervix and no more; whereas in a primary prolapse the relaxed vagina is very much increased both in length and in width and lies in front of the vulva in large folds. In primary prolapse of the posterior vaginal vault the ascitic collection, if present, may be discovered by a dull percussion note over Douglas' space, and by the ease with which the fluid can be pushed back; the posterior vaginal enterocele is recognized by the tympany and by feeling the ribbon-like coils of intestine.

After the condition of the vagina has been determined, the extent to which the uterus is prolapsed is investigated. In a few cases it is not involved in the vaginal prolapse at all and is found at its normal level and in correct anteversion. This condition is most frequently seen with a moderate descent of the lowest portion of the vaginal wall, and occasionally also with greater degrees of prolapse of the posterior wall (see Fig. 110). In the great majority of cases of prolapse, however, the descent of the uterus plays a most important part. We distinguish two different conditions.

Uterus.

1. Primary Descent and Prolapse of the Uterus.—This occurs in conditions of relaxation of the peritoneum and its ligaments and of the pelvic connective tissue. It is therefore regularly associated with retroversion, which occurs from the same cause. The vaginal portion is in the pelvic axis below the interspinal line. The upper portion of the vagina is inverted, while the introitus and the lower segments may be normal (Fig. 111); in most cases, however, the latter are also relaxed and displaced downward. In more severe grades of primary descent the vaginal portion enters the introitus, and in a fully developed total prolapse the uterus, covered with the completely inverted vagina, lies in front of the vulva, usually in retroversioflexion, rarely in anteflexion (Fig. 112). In a smaller number of cases the uterine prolapse is associated only with prolapse of the posterior vaginal wall, while the anterior wall merely presents a slight degree of inversion from above.

Primary Descent and Prolapse of the Uterus.

2. Secondary Descent of the Uterus with Elongation of the Cervix.—This condition also is ushered in by a slight descent of the uterus with retroversion, due to relaxation of the peritoneal ligaments and pelvic connective tissue, which usually develops simultaneously with the relaxation of the vaginal walls. As the relaxation continues, however, the uterus is drawn down by the prolapsed anterior vaginal wall aided by a cystocele, which is connected over a wide extent with the anterior

wall of the vagina and cervix. The uterus offers no resistance to the pull thus exerted until the vaginal portion approximately reaches the introitus. (In this manner secondary descent of the uterus is produced in primary prolapse of the anterior vaginal wall with cystocele, Fig. 109.) Further displacement is temporarily prevented by the peritoneal ligaments and the pelvic connective tissue, and instead the cervix is slowly distended by the continued pull of the anterior vaginal wall and of the

Secondary Descent of the Uterus, with Elongation of the Cervix.

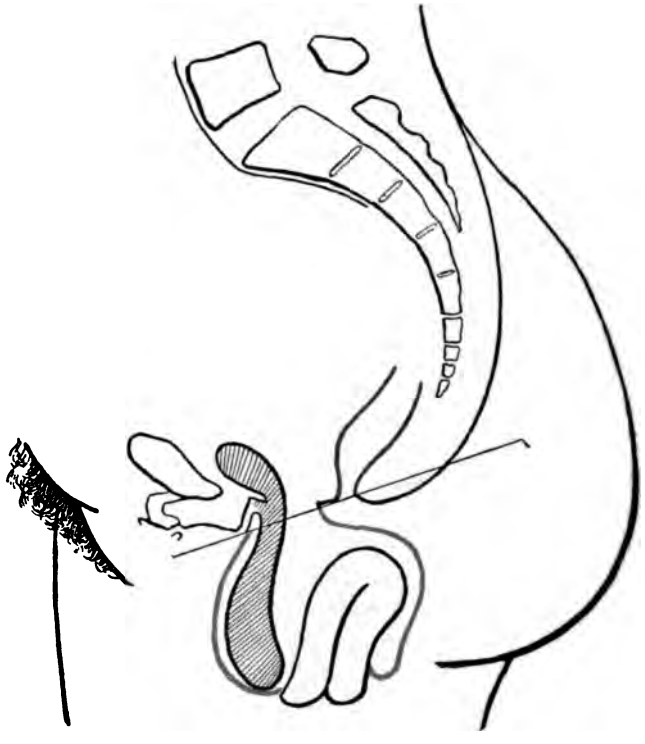

FIG. 112.—TOTAL PROLAPSE OF VAGINA AND UTERUS. P.-F. ⅓. (Original.) Uterus 7 cm.; large cystocle, no rectocele.

cystocele; elongation of the cervix is produced. This at first, it is needless to say, affects chiefly the anterior wall because it is directly connected with the bladder; but, as the cervix represents a coherent mass, the elongation must—although to a slighter degree—cause elongation of the lateral and posterior walls also. The two walls of the cervix do not share equally in the elongation. In the anterior wall only the supravaginal portion, with which the bladder is directly connected, becomes elongated; while in the posterior wall the elongation may affect both the supra- and infravaginal segments. If the infravaginal portion only is affected and there is no primary

Elongation of the Cervix.

descent of the uterus, the posterior vaginal vault is found completely at its normal level (Schröder's hypertrophia intermedia). This form is very rare, however, because in this case also there usually occurs primarily a slight descent of the uterus with inversion of the vagina. As a rule the reflexion of the posterior wall is found at about the middle of the vagina (Fig. 114), and the elongation involves the supravaginal,

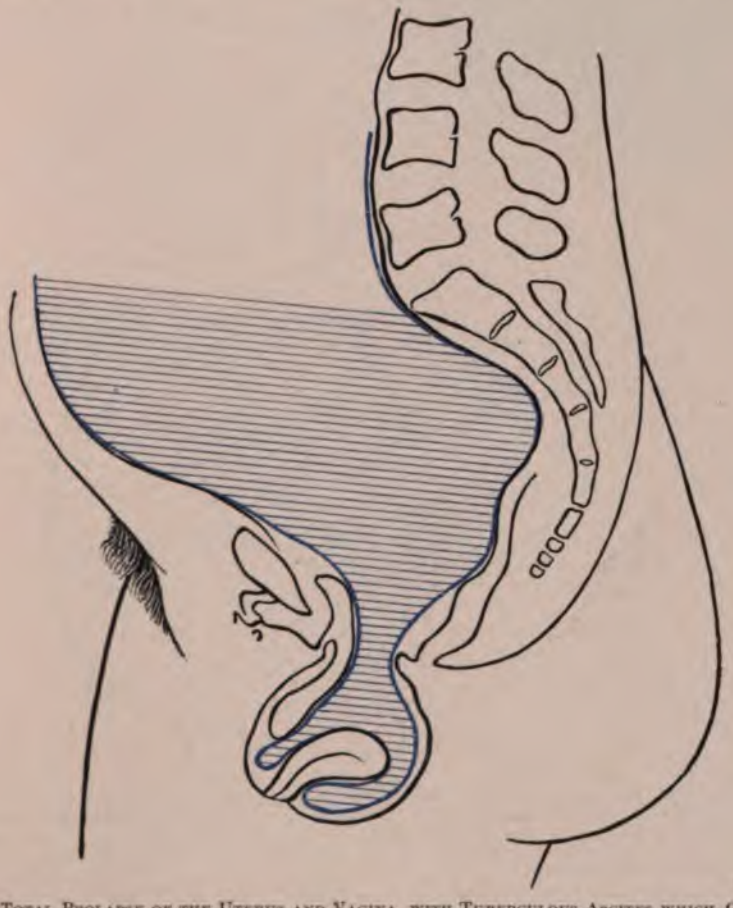

Fig. 113.—Total Prolapse of the Uterus and Vagina, with Tuberculous Ascites which Completely Fills the Vesico-uterine and Recto-uterine Excavations. P.-F. ⅓. (Original.)

and in a smaller degree the infravaginal, portions of the posterior cervical wall. In rarer cases the supravaginal portion only of the posterior cervical wall is elongated (Fig. 115). This occurs in those cases in which there is a primary prolapse of the lower portion of the posterior vaginal wall, and in which the inversion of the vagina caused by the descent of the uterus has continued until it coincides with the primary vaginal prolapse, and the entire vagina is rolled down. The entire posterior wall of the vagina in that case lies in front of the vulva in

large folds, and the elongation of both cervical walls affects only the portion lying above the vagina.

It appears, therefore, that secondary prolapse of the uterus usually terminates in elongation of the cervix; exceptional combinations of primary vaginal prolapse and primary uterine prolapse may occur.

All the parts lying in front of the vulva may become edematous from circulatory disturbances and, if the latter are protracted, hypertrophic; as a result the vaginal portion becomes thickened, hard and

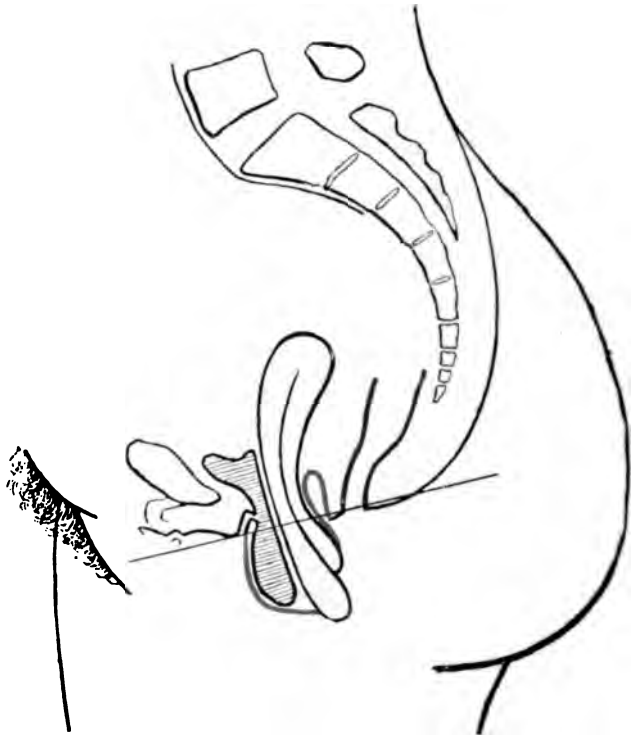

FIG. 114.—PROLAPSE OF THE ANTERIOR VAGINAL WALL WITH ELONGATION OF THE CERVIX. P.-F. ⅓. (Original.) The anterior wall is completely prolapsed; the posterior has descended from above and is *in situ* below. The supravaginal portion of the cervix, particularly in the anterior wall, is elongated. The uterus 11 cm., in retroflexion.

sometimes a little longer than normal. In nulliparæ it retains its shape in the main, and the os, which occasionally is so small that it can barely be found, remains normal; in multiparæ marked changes in the shape occur on account of the bilateral tears which are usually present. The two lips of the cervix, with their lateral tears, are drawn apart by the pull of the two prolapsed vaginal walls to such an extent that a large ectropion is formed, and the external os is displaced to the outer surface of the prolapse, while the lowest point of the prolapse is formed by the inner wall of the cervix or occasionally by the internal os; as a result the external os is enormously dilated.

Secondary Changes in the Uterus.

If there is only one lateral tear, only one ectropion is formed on the corresponding side and the os becomes oblique. The mucous membrane of the cervix which is exposed by the ectropion becomes covered with squamous epithelium, as do also the small mucous polyps which not infrequently develop; the epithelium remains thin, however, appears bluish and is easily injured. In spite of the changes in the epithelium the arbor vitæ is still distinctly recognizable. Shallow, decubital ulcers are very apt to form on the inner surface of the cervix. Elongation of

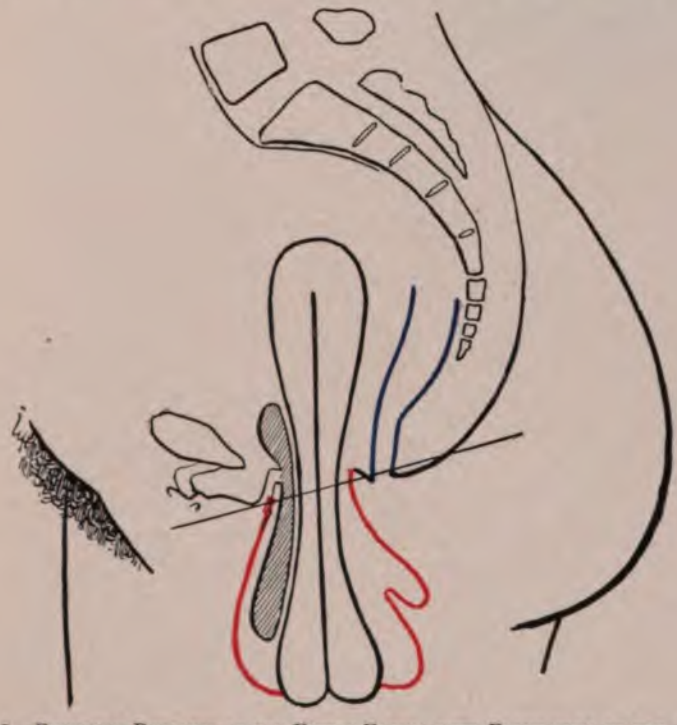

Fig. 115.—Enormous Prolapse of the Entire Vagina with Elongation of the Cervix. P.-F. ⅕. (Original.) Vagina very thick, edematous, wrinkled behind; cystocele with marked fluctuation; no rectocele; uterus 19.5 cm. Ectropion of the cervix.

the cervix must also be regarded as a secondary alteration; those portions of the elongated cervix which lie within the pelvis possess their normal thickness or may be greatly attenuated, while the parts in front of the vulva become hypertrophied.

Diagnosis of the Uterine Displacement.

It is not difficult to determine whether the uterus has shared in the prolapse. If the uterus is still within the pelvis, its position is determined by bimanual examination through the vagina, taking great care not to displace the organ upward. The points to be decided are, in the main, the level of the uterus, which is determined by the position of the vaginal portion with respect to the interspinal line, and whether the organ is normally ante-

verted or in retroversion. If, however, the vaginal portion has descended as far as the introitus, the position of the uterus can no longer be determined by vaginal examination, because in doing so it would be forced upward; in that case the position of the organ is determined by rectal examination, while the patient is asked to bear down or the cervix is drawn down with a tenaculum. If the vaginal portion protrudes far below the vulva, or if the entire vagina is prolapsed, the main question to be decided is whether one is dealing with a total uterine prolapse or an elongation of the cervix. This is decided by palpation and by attempting to outline the uterus, which is covered by the prolapsed vagina. If the fingers can still be brought together above the fundus and in front of the vulva, the entire uterus is prolapsed. If, however, external palpation shows that part of the uterus is within the pelvis, the condition is an elongation of the cervix, and, in order to determine whether it extends farther into the pelvis, a rectal examination is necessary. The junction between the cervix and the uterine body can sometimes be recognized by the attachment of the folds of Douglas. If the intrapelvic portion of the uterus is not elongated, the fundus can be drawn down in front of the vulva through the rectum, and an elongation apparently converted into total uterine prolapse. A much simpler means, however, of distinguishing between total uterine prolapse and elongation is the sound. In total uterine prolapse the length of the uterus is found to be normal, while in elongation it may measure as much as 20 cm. (It must be borne in mind that in prolapse, owing to the retroversion, the sound must be introduced with the concavity directed backward.) Peculiar differences in the length of the uterine canal are sometimes obtained with the sound; if the elongated cervix is completely drawn out (extended) and lies partly within, and partly in front of the pelvis, a measurement of 12 cm. is obtained; if the uterine body is brought out through the rectum and placed in retroflexion, the cervix collapses in folds like a harmonica and, as these folds are not included in the measurement, the sound shows a length of 7 cm. For the same reason great differences may be obtained in the results of sounding immediately before, and after replacement of the uterus. The extent to which the cervix shares in the entire elongation cannot be determined with the sound alone because the internal os is not sufficiently well marked. More reliable information is often obtained by palpating the sacro-uterine ligaments which are attached a short distance below the internal os.

The question which part of the cervix is elongated merits a careful study. In the anterior wall it is only the supravaginal portion that lengthens out; in the posterior we have several possibilities—the infravaginal portion alone, or the supravaginal portion, or both may be

elongated. The differentiation between these three conditions is made by the level of the vaginal vault. In the first condition it is found at its normal level; in the second it lies in front of the vulva just as in elongation of the anterior wall; while both segments must be assumed to be involved if the vaginal vault is found about half-way up. In addition the character of the elongation may be determined by the nature of the investing mucous membrane on the posterior surface of the prolapse; if the mucous membrane is smooth and without wrinkles and immovably attached to the cervix, the structure is the vaginal portion; while those segments which are covered with wrinkled, plicated, movable mucous membrane represent the supravaginal portion of the cervix.

Bladder and Urethra.

The floor of the bladder is almost inseparably attached to the upper half of the anterior vaginal wall and to the anterior cervical wall. For this reason the bladder is necessarily involved in all cases of vaginal prolapse—in some cases primarily and in rare cases secondarily. The shape of the viscus varies according to the position occupied by the anterior vaginal wall and cervix. In every case of descent and prolapse of the anterior vaginal wall the lower portion of the bladder descends in front of the vulva and forms a sacculation, a cystocele. This is also found regularly when, in a primary uterine prolapse or elongation of the cervix, the posterior wall of the bladder descends along with the anterior cervical wall; but the size of the cystocele is different in the two conditions. When the anterior cervical wall is elongated, the attachment of the bladder to the cervix is lengthened by from 2 to 10 or 12 cm., and the cystocele is accordingly long and broad (Fig. 115); when, on the other hand, the uterus is primarily prolapsed, the bladder wall is merely dragged down to the cervix and forms a much smaller cystocele.

Along with the bladder the posterior half of the urethra is displaced downward, while the anterior remains permanently attached to the lower border of the symphysis—the urethra representing a curve with the concavity directed downward as it courses into the bladder. The altered position of the urethra is readily determined with the catheter; the instrument is introduced in the usual position and the tip rotated downward. The bladder can occasionally be seen as an ill-defined bulging or sacculation behind the anterior vaginal wall or, if it contains urine, it may be demonstrable as a flabby tumor, or picked up from the cervix as a thick fold along with the vaginal wall; the lower extremity of the bladder is usually indicated by a transverse furrow. The readiest means of recognizing the altered shape of the bladder is the catheter, with the aid of which the boundaries can be determined in all directions; but at the same time the instrument is apt to evaginate the bladder wall

and temporarily alter its position. In the recumbent posture the cystocele usually contains no urine.

Cystoscopy affords an excellent method of examining the cystocele. The earliest stages of depression of the bladder wall may be recognized with the cystoscope as a small fold or pouch in the trigonum, forming the centre of the radiating folds of the adjacent mucous membrane. The deeper the pocket, the nearer will be the interureteric ligaments to the neck of the bladder; the ligament at the same time is curved or makes an acute angle (Fig. 116). When the cystocele is large, the entire floor and posterior wall of the bladder, and with them the orifices of the ureters, are found in a funnel-shaped depression of the cystocele. By pushing the prism of the cystoscope forward into the cystocele and greatly elevating the upper

FIG. 116.— CYSTOSCOPIC PICTURE OF SMALL CYSTOCELE, SHOWING THE INTERURETERIC LIGAMENT PASSING INTO IT (modified after Zangemeister).

FIG. 117.— CYSTOSCOPIC PICTURE OF CYSTOCELE IN FRONT OF THE VULVA (modified after Zangemeister).

extremity the ureteric orifices are discovered on the anterior wall. From this point the ureters pass in a curved direction laterally and upward (Zangemeister) (Fig. 117). With the aid of the cystoscope, therefore, it is not difficult to obtain an idea of the size of the cystocele and the position of the ureters.

The lower half of the posterior vaginal wall is connected with the anterior wall of the rectum by loose tissue which permits a considerable degree of mobility. Hence the posterior vaginal wall may descend a considerable distance, or even become completely prolapsed, without necessarily dragging the rectum down with it. In other cases we find a marked sacculation of the anterior rectal wall—rectocele, which sometimes is merely a secondary effect of the bulging of the posterior vaginal wall. The recognition of this alteration in the rectum is quite easy. The finger is introduced into the rectum, and the position of the anterior rectal wall determined, care being taken not to push the wall forward and thus produce an artificial rectocele.

Rectum.

After the participation of all the organs in the prolapse has been investigated, it remains to be determined whether the prolapse can be replaced, *i.e.*, whether the vagina and uterus can be returned to their normal positions within the pelvis, as successful treatment depends primarily on the possibility of complete replacement. An anesthetic is required for this purpose only in exceptional cases; when the vaginal walls are very edematous or extremely painful, replacement is much more easily effected under an anesthetic. The prolapse is grasped by placing both thumbs against the anterior, and the remaining fingers against the posterior wall of the prolapse; and the first part of the vagina nearest the vulva, then the adjacent portions, and finally the vaginal portion are pushed back into place. After the vagina has been completely replaced, the uterus is turned over forward, anteverted as in retroflexion, by bringing the body forward and pushing the vagina backward (p. 252). It is of the greatest importance that the uterus be restored to its normal position. Moderate grades of edema of the vaginal wall, which may interfere with replacement, are removed by massage. The most frequent obstacles to the replacement of the uterus are found in parametritic exudates, perimetritic adhesions and parauterine tumors. After the prolapse has been replaced, a better idea can be formed of the width of the introitus and the relaxation of the pelvic floor. In marked degrees of prolapse the introitus is wide enough to admit the entire hand into the vagina.

Method of Determining Whether Reposition is Possible.

Differential diagnosis. In prolapse, as in all other gynecologic conditions, the diagnosis must be based on the objective signs and not on the symptoms. The patient's statements about bearing-down pains and the sensation of swelling of the vulva are by no means typical of prolapse, as the same symptoms are sometimes complained of in vulvitis, colpitis, inflammation of the uterus and neighboring organs, and in some tumors; if at the same time a slight degree of descent is present, one is tempted to regard this as the cause of the symptoms and to overlook the other conditions.

Differential Diagnosis.

Diagnostic errors are possible even when an objective examination is made. Thus a cystocele protruding into the introitus may produce a picture very similar to that of prolapse of the vagina; such a cystocele, however, is usually situated to one side of the median line, the investing mucous membrane is greatly attenuated, the wrinkles are obliterated, and the contents of the cystocele appear as a bluish sheen in the attenuated wall. As a rule the cystocele may be recognized as a circumscribed, flabby, fluctuating tumor.

Prolapse of the posterior wall may be simulated by a vaginal septum which has been torn from the anterior wall and protrudes from

the lower half remains in its normal position. This form of prolapse is most frequently observed in cases of great ascites; the uniform pressure of the fluid slowly forces the posterior vaginal wall downward until it appears in the vulva. In a similar manner this portion of the vaginal wall may be protruded by the pressure of coils of intestine occupying Douglas' space (posterior vaginal enterocele). In rare cases of infantile development congeni-

Prolapse of Posterior Vaginal Wall.

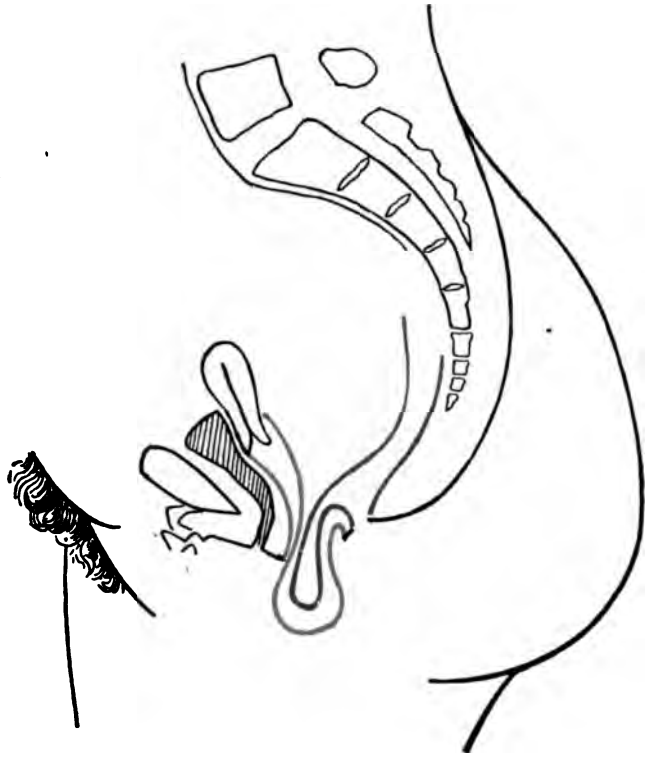

FIG. 110.—PRIMARY ISOLATED PROLAPSE OF THE POSTERIOR VAGINAL WALL WITH LARGE RECTOCELE. P.-F. ⅓. (Original.) The senile uterus, also the anterior vaginal wall, occupies the normal level. The posterior vaginal wall forms a large pouch in front of the vulva and contains an extensive rectocele.

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In prolapse of the entire vagina the latter is entirely in front of the vulva (Fig. 112), and the reflexion of the mucous membrane is therefore seen in the form of a complete circle immediately behind the introitus. Posteriorly the fossa navicularis, which belongs to the vestibule, of course remains *in situ;* the appearance of this fossa often gives the impression that the posterior vaginal wall is not completely prolapsed, but the mucous membrane is easily recognized as belonging to the vestibule by the absence of wrinkles

Total Prolapse of Vagina.

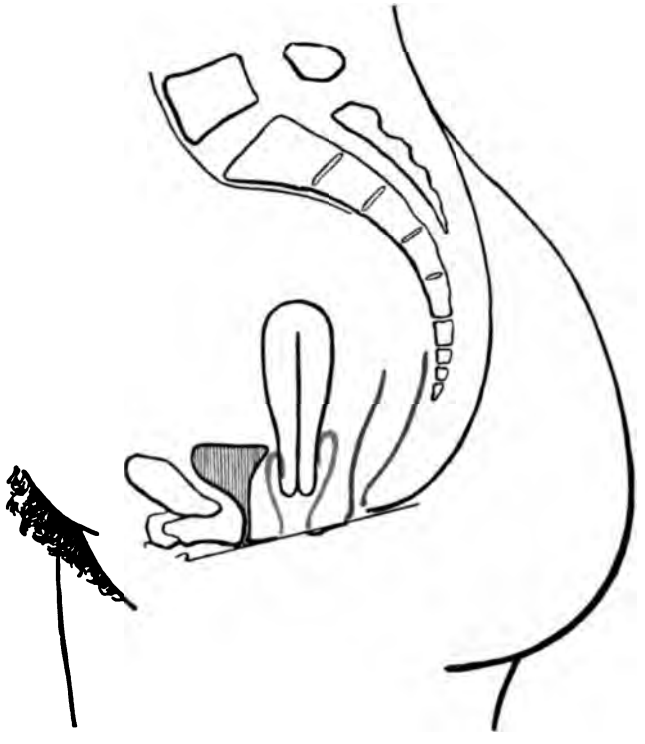

FIG 111.—PRIMARY DESCENT OF THE UTERUS WITH INVERSION OF THE VAGINA. P.-F. ⅓. (Original.) Retroverted and prolapsed uterus, 7 cm. The introitus is contracted. The vagina below *in situ* and above, inverted.

and folds (rugæ). Occasionally the prolapsed vagina may present irregular retractions produced by bands of scar-tissue connecting such points with the pelvic wall and fixing this portion of the vagina. In this manner fixation of the cervix may occasionally keep up the entire vaginal vault, while the lower portions lie in front of the vulva in complete prolapse.

Inversion of the vagina, in contradistinction to prolapse of the vagina in which the lowest portions are always first to be displaced, is a circular invagination of the vagina beginning at the vaginal vault and, in its subsequent development, successively causing downward displacement of the lower portions of the canal (Fig. 111). Inversion

is the result of a primary descent of the uterus; if the uterus drops from above it carries with it the vaginal vault, while the lower portions of the vagina either remain completely *in situ* or merely suffer slight relaxation. In severer grades of uterine prolapse the vagina becomes shorter and shorter, until the vaginal portion appears in the introitus. When the vagina is completely inverted it often lies in front of the vulva in the same way as in total primary prolapse. Combinations of inversion and descent of the vagina are frequently encountered; the lower portions are relaxed and prolapsed, while the vaginal vault is somewhat depressed and invaginated. The intermediate parts may at first remain unchanged.

Inversion of the Vagina.

The parts of the vagina that are prolapsed in front of the vulva and no longer covered by the mucous membrane of the introitus and of the labia majora, lose their character of mucous membrane, become dry and horny and assume the appearance of skin. Owing to the absence of sebaceous glands they lose their softness and elasticity, and the surface becomes fissured and covered with crusts. Occasionally pigmentation takes place.

Secondary Changes in the Vagina.

As a result of external irritation decubital ulcers may develop on all the prolapsed parts, particularly the vaginal portion of the cervix. The ulcers are usually circular, sometimes irregular in outline or stellate, with a sharply defined, somewhat infiltrated border and no tendency to cicatrization. The floor of the ulcers is usually covered with a yellow exudate; they are soft and therefore readily distinguished from carcinoma. Constriction of the prolapsed parts of the introitus may produce edematous swelling of the mucous membrane, which becomes thick and glistening, and its wrinkles occasionally stand out in heavy ridges. In cases of chronic prolapse this leads to the development of hypertrophic conditions of the entire vagina.

Diagnosis of the displacements of the vagina. The labia majora are separated and the patient is asked to bear down with moderate force; this is followed by protrusion into the introitus of a tumor of variable size, which is recognized as vaginal mucous membrane by its transverse folds. Whether it consists of one or both walls is determined by the position of the lumen of the vagina, which forms a transverse cleft, and the merging of the prolapse with the anterior, or the posterior commissure. The initial stages of prolapse of the vagina, which consist merely in relaxation and loosening of its attachments to neighboring structures, are recognized in the anterior vaginal wall by the fact that it yields more readily to the pressure of the finger; in the posterior, by its greater mobility and looser attachment to the rectum, and the ease with which it can be picked up in folds. A beginning inversion is recognized by

Diagnosis of Displacements of the Vagina.

the descent of the vaginal vault. If the vagina lies entirely in front of the vulva, it may be difficult to decide between prolapse and inversion; as a rule a hint is obtained from the fact that in inversion only so much of the vagina is outside of the vulva as has been carried down by the cervix, *i.e.*, as much as is necessary for covering the cervix and no more; whereas in a primary prolapse the relaxed vagina is very much increased both in length and in width and lies in front of the vulva in large folds. In primary prolapse of the posterior vaginal vault the ascitic collection, if present, may be discovered by a dull percussion note over Douglas' space, and by the ease with which the fluid can be pushed back; the posterior vaginal enterocele is recognized by the tympany and by feeling the ribbon-like coils of intestine.

After the condition of the vagina has been determined, the extent to which the uterus is prolapsed is investigated. In a few cases it is not involved in the vaginal prolapse at all and is found at its normal level and in correct anteversion. This condition is most frequently seen with a moderate descent of the lowest portion of the vaginal wall, and occasionally also with greater degrees of prolapse of the posterior wall (see Fig. 110). In the great majority of cases of prolapse, however, the descent of the uterus plays a most important part. We distinguish two different conditions.

Uterus.

1. Primary Descent and Prolapse of the Uterus.—This occurs in conditions of relaxation of the peritoneum and its ligaments and of the pelvic connective tissue. It is therefore regularly associated with retroversion, which occurs from the same cause. The vaginal portion is in the pelvic axis below the interspinal line. The upper portion of the vagina is inverted, while the introitus and the lower segments may be normal (Fig. 111); in most cases, however, the latter are also relaxed and displaced downward. In more severe grades of primary descent the vaginal portion enters the introitus, and in a fully developed total prolapse the uterus, covered with the completely inverted vagina, lies in front of the vulva, usually in retroversioflexion, rarely in anteflexion (Fig. 112). In a smaller number of cases the uterine prolapse is associated only with prolapse of the posterior vaginal wall, while the anterior wall merely presents a slight degree of inversion from above.

Primary Descent and Prolapse of the Uterus.

2. Secondary Descent of the Uterus with Elongation of the Cervix.—This condition also is ushered in by a slight descent of the uterus with retroversion, due to relaxation of the peritoneal ligaments and pelvic connective tissue, which usually develops simultaneously with the relaxation of the vaginal walls. As the relaxation continues, however, the uterus is drawn down by the prolapsed anterior vaginal wall aided by a cystocele, which is connected over a wide extent with the anterior

wall of the vagina and cervix. The uterus offers no resistance to the pull thus exerted until the vaginal portion approximately reaches the introitus. (In this manner secondary descent of the uterus is produced in primary prolapse of the anterior vaginal wall with cystocele, Fig. 109.) Further displacement is temporarily prevented by the peritoneal ligaments and the pelvic connective tissue, and instead the cervix is slowly distended by the continued pull of the anterior vaginal wall and of the

Secondary Descent of the Uterus, with Elongation of the Cervix.

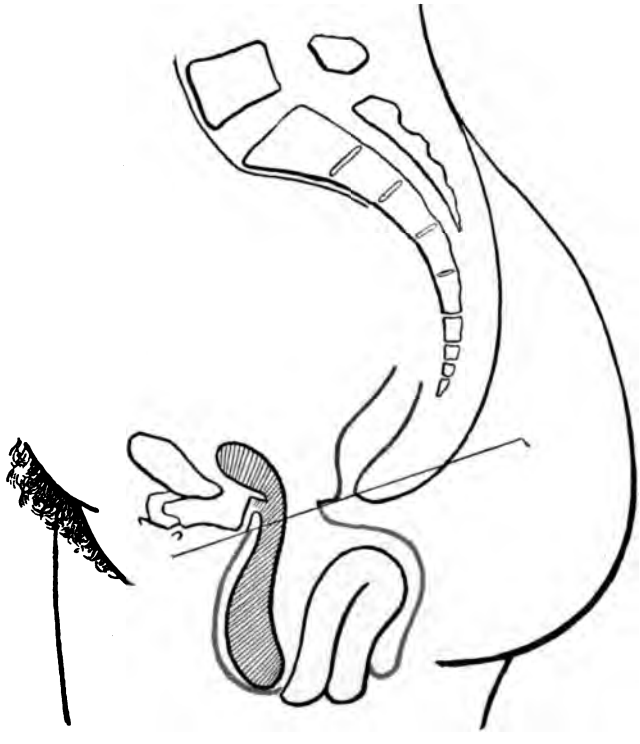

FIG. 112.—TOTAL PROLAPSE OF VAGINA AND UTERUS. P.-F. ¼. (Original.) Uterus 7 cm.; large cystocle, no rectocele.

cystocele; elongation of the cervix is produced. This at first, it is needless to say, affects chiefly the anterior wall because it is directly connected with the bladder; but, as the cervix represents a coherent mass, the elongation must—although to a slighter degree—cause elongation of the lateral and posterior walls also. The two walls of the cervix do not share equally in the elongation. In the anterior wall only the supravaginal portion, with which the bladder is directly connected, becomes elongated; while in the posterior wall the elongation may affect both the supra- and infravaginal segments. If the infravaginal portion only is affected and there is no primary

Elongation of the Cervix.

descent of the uterus, the posterior vaginal vault is found completely at its normal level (Schröder's hypertrophia intermedia). This form is very rare, however, because in this case also there usually occurs primarily a slight descent of the uterus with inversion of the vagina. As a rule the reflexion of the posterior wall is found at about the middle of the vagina (Fig. 114), and the elongation involves the supravaginal,

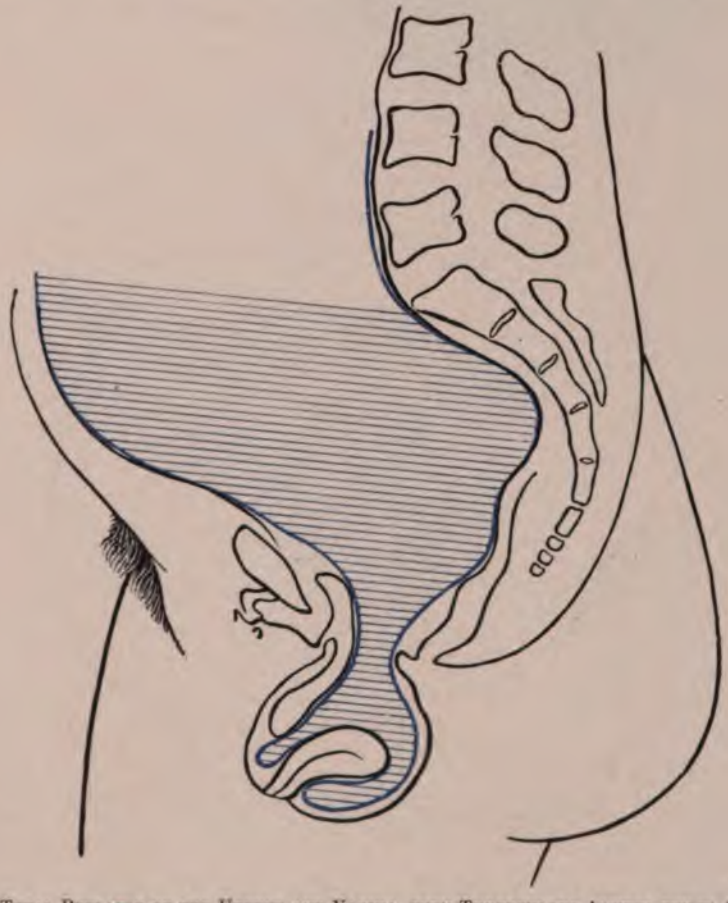

Fig. 113.—Total Prolapse of the Uterus and Vagina, with Tuberculous Ascites which Completely Fills the Vesico-uterine and Recto-uterine Excavations. P.-F. ⅓. (Original.)

and in a smaller degree the infravaginal, portions of the posterior cervical wall. In rarer cases the supravaginal portion only of the posterior cervical wall is elongated (Fig. 115). This occurs in those cases in which there is a primary prolapse of the lower portion of the posterior vaginal wall, and in which the inversion of the vagina caused by the descent of the uterus has continued until it coincides with the primary vaginal prolapse, and the entire vagina is rolled down. The entire posterior wall of the vagina in that case lies in front of the vulva in

large folds, and the elongation of both cervical walls affects only the portion lying above the vagina.

It appears, therefore, that secondary prolapse of the uterus usually terminates in elongation of the cervix; exceptional combinations of primary vaginal prolapse and primary uterine prolapse may occur.

All the parts lying in front of the vulva may become edematous from circulatory disturbances and, if the latter are protracted, hypertrophic; as a result the vaginal portion becomes thickened, hard and

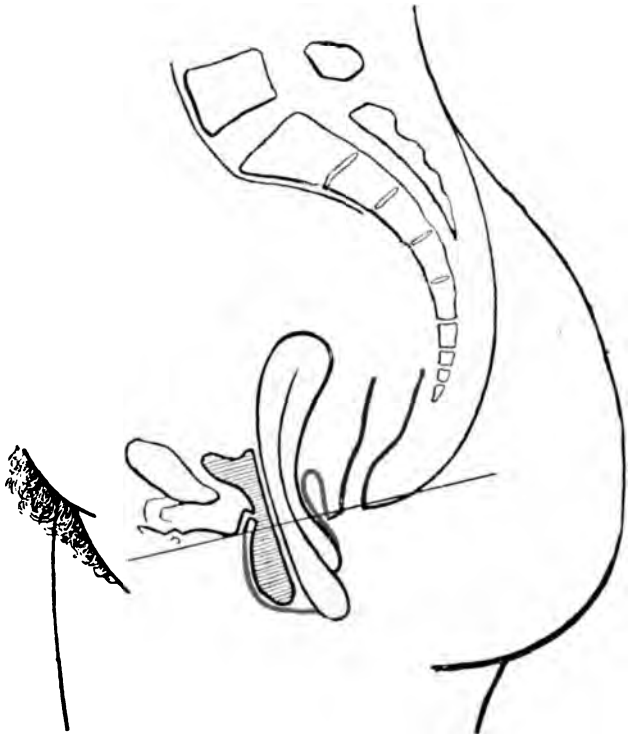

FIG. 114.—PROLAPSE OF THE ANTERIOR VAGINAL WALL WITH ELONGATION OF THE CERVIX. P.-F. ⅓. (Original.) The anterior wall is completely prolapsed; the posterior has descended from above and is *in situ* below. The supravaginal portion of the cervix, particularly in the anterior wall, is elongated. The uterus 11 cm., in retroflexion.

sometimes a little longer than normal. In nulliparæ it retains its shape in the main, and the os, which occasionally is so small that it can barely be found, remains normal; in multiparæ marked changes in the shape occur on account of the bilateral tears which are usually present. The two lips of the cervix, with their lateral tears, are drawn apart by the pull of the two prolapsed vaginal walls to such an extent that a large ectropion is formed, and the external os is displaced to the outer surface of the prolapse, while the lowest point of the prolapse is formed by the inner wall of the cervix or occasionally by the internal os; as a result the external os is enormously dilated.

Secondary Changes in the Uterus.

If there is only one lateral tear, only one ectropion is formed on the corresponding side and the os becomes oblique. The mucous membrane of the cervix which is exposed by the ectropion becomes covered with squamous epithelium, as do also the small mucous polyps which not infrequently develop; the epithelium remains thin, however, appears bluish and is easily injured. In spite of the changes in the epithelium the arbor vitæ is still distinctly recognizable. Shallow, decubital ulcers are very apt to form on the inner surface of the cervix. Elongation of

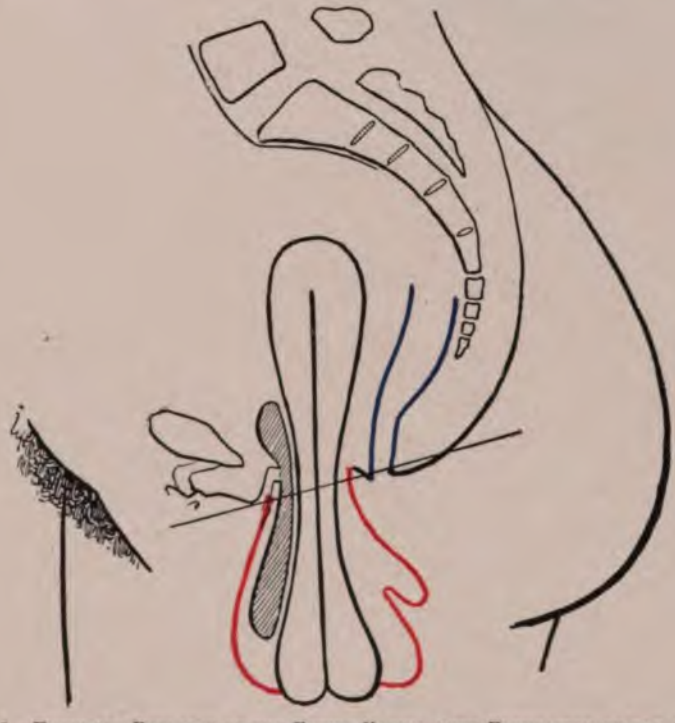

Fig. 115.—Enormous Prolapse of the Entire Vagina with Elongation of the Cervix. P.-F. ⅓. (Original.) Vagina very thick, edematous, wrinkled behind; cystocele with marked fluctuation; no rectocele; uterus 19.5 cm. Ectropion of the cervix.

the cervix must also be regarded as a secondary alteration; those portions of the elongated cervix which lie within the pelvis possess their normal thickness or may be greatly attenuated, while the parts in front of the vulva become hypertrophied.

Diagnosis of the Uterine Displacement.

It is not difficult to determine whether the uterus has shared in the prolapse. If the uterus is still within the pelvis, its position is determined by bimanual examination through the vagina, taking great care not to displace the organ upward. The points to be decided are, in the main, the level of the uterus, which is determined by the position of the vaginal portion with respect to the interspinal line, and whether the organ is normally ante-

verted or in retroversion. If, however, the vaginal portion has descended as far as the introitus, the position of the uterus can no longer be determined by vaginal examination, because in doing so it would be forced upward; in that case the position of the organ is determined by rectal examination, while the patient is asked to bear down or the cervix is drawn down with a tenaculum. If the vaginal portion protrudes far below the vulva, or if the entire vagina is prolapsed, the main question to be decided is whether one is dealing with a total uterine prolapse or an elongation of the cervix. This is decided by palpation and by attempting to outline the uterus, which is covered by the prolapsed vagina. If the fingers can still be brought together above the fundus and in front of the vulva, the entire uterus is prolapsed. If, however, external palpation shows that part of the uterus is within the pelvis, the condition is an elongation of the cervix, and, in order to determine whether it extends farther into the pelvis, a rectal examination is necessary. The junction between the cervix and the uterine body can sometimes be recognized by the attachment of the folds of Douglas. If the intrapelvic portion of the uterus is not elongated, the fundus can be drawn down in front of the vulva through the rectum, and an elongation apparently converted into total uterine prolapse. A much simpler means, however, of distinguishing between total uterine prolapse and elongation is the sound. In total uterine prolapse the length of the uterus is found to be normal, while in elongation it may measure as much as 20 cm. (It must be borne in mind that in prolapse, owing to the retroversion, the sound must be introduced with the concavity directed backward.) Peculiar differences in the length of the uterine canal are sometimes obtained with the sound; if the elongated cervix is completely drawn out (extended) and lies partly within, and partly in front of the pelvis, a measurement of 12 cm. is obtained; if the uterine body is brought out through the rectum and placed in retroflexion, the cervix collapses in folds like a harmonica and, as these folds are not included in the measurement, the sound shows a length of 7 cm. For the same reason great differences may be obtained in the results of sounding immediately before, and after replacement of the uterus. The extent to which the cervix shares in the entire elongation cannot be determined with the sound alone because the internal os is not sufficiently well marked. More reliable information is often obtained by palpating the sacro-uterine ligaments which are attached a short distance below the internal os.

The question which part of the cervix is elongated merits a careful study. In the anterior wall it is only the supravaginal portion that lengthens out; in the posterior we have several possibilities—the infravaginal portion alone, or the supravaginal portion, or both may be

elongated. The differentiation between these three conditions is made by the level of the vaginal vault. In the first condition it is found at its normal level; in the second it lies in front of the vulva just as in elongation of the anterior wall; while both segments must be assumed to be involved if the vaginal vault is found about half-way up. In addition the character of the elongation may be determined by the nature of the investing mucous membrane on the posterior surface of the prolapse; if the mucous membrane is smooth and without wrinkles and immovably attached to the cervix, the structure is the vaginal portion; while those segments which are covered with wrinkled, plicated, movable mucous membrane represent the supravaginal portion of the cervix.

Bladder and Urethra.

The floor of the bladder is almost inseparably attached to the upper half of the anterior vaginal wall and to the anterior cervical wall. For this reason the bladder is necessarily involved in all cases of vaginal prolapse—in some cases primarily and in rare cases secondarily. The shape of the viscus varies according to the position occupied by the anterior vaginal wall and cervix. In every case of descent and prolapse of the anterior vaginal wall the lower portion of the bladder descends in front of the vulva and forms a sacculation, a cystocele. This is also found regularly when, in a primary uterine prolapse or elongation of the cervix, the posterior wall of the bladder descends along with the anterior cervical wall; but the size of the cystocele is different in the two conditions. When the anterior cervical wall is elongated, the attachment of the bladder to the cervix is lengthened by from 2 to 10 or 12 cm., and the cystocele is accordingly long and broad (Fig. 115); when, on the other hand, the uterus is primarily prolapsed, the bladder wall is merely dragged down to the cervix and forms a much smaller cystocele.

Along with the bladder the posterior half of the urethra is displaced downward, while the anterior remains permanently attached to the lower border of the symphysis—the urethra representing a curve with the concavity directed downward as it courses into the bladder. The altered position of the urethra is readily determined with the catheter; the instrument is introduced in the usual position and the tip rotated downward. The bladder can occasionally be seen as an ill-defined bulging or sacculation behind the anterior vaginal wall or, if it contains urine, it may be demonstrable as a flabby tumor, or picked up from the cervix as a thick fold along with the vaginal wall; the lower extremity of the bladder is usually indicated by a transverse furrow. The readiest means of recognizing the altered shape of the bladder is the catheter, with the aid of which the boundaries can be determined in all directions; but at the same time the instrument is apt to evaginate the bladder wall

and temporarily alter its position. In the recumbent posture the cystocele usually contains no urine.

Cystoscopy affords an excellent method of examining the cystocele. The earliest stages of depression of the bladder wall may be recognized with the cystoscope as a small fold or pouch in the trigonum, forming the centre of the radiating folds of the adjacent mucous membrane. The deeper the pocket, the nearer will be the interureteric ligaments to the neck of the bladder; the ligament at the same time is curved or makes an acute angle (Fig. 116). When the cystocele is large, the entire floor and posterior wall of the bladder, and with them the orifices of the ureters, are found in a funnel-shaped depression of the cystocele. By pushing the prism of the cystoscope forward into the cystocele and greatly elevating the upper

FIG. 116.—CYSTOSCOPIC PICTURE OF SMALL CYSTOCELE, SHOWING THE INTERURETERIC LIGAMENT PASSING INTO IT (modified after Zangemeister).

FIG. 117.—CYSTOSCOPIC PICTURE OF CYSTOCELE IN FRONT OF THE VULVA (modified after Zangemeister).

extremity the ureteric orifices are discovered on the anterior wall. From this point the ureters pass in a curved direction laterally and upward (Zangemeister) (Fig. 117). With the aid of the cystoscope, therefore, it is not difficult to obtain an idea of the size of the cystocele and the position of the ureters.

Rectum.

The lower half of the posterior vaginal wall is connected with the anterior wall of the rectum by loose tissue which permits a considerable degree of mobility. Hence the posterior vaginal wall may descend a considerable distance, or even become completely prolapsed, without necessarily dragging the rectum down with it. In other cases we find a marked sacculation of the anterior rectal wall—rectocele, which sometimes is merely a secondary effect of the bulging of the posterior vaginal wall. The recognition of this alteration in the rectum is quite easy. The finger is introduced into the rectum, and the position of the anterior rectal wall determined, care being taken not to push the wall forward and thus produce an artificial rectocele.

After the participation of all the organs in the prolapse has been investigated, it remains to be determined whether the prolapse can be replaced, *i.e.*, whether the vagina and uterus can be returned to their normal positions within the pelvis, as successful treatment depends primarily on the possibility of complete replacement. An anesthetic is required for this purpose only in exceptional cases; when the vaginal walls are very edematous or extremely painful, replacement is much more easily effected under an anesthetic. The prolapse is grasped by placing both thumbs against the anterior, and the remaining fingers against the posterior wall of the prolapse; and the first part of the vagina nearest the vulva, then the adjacent portions, and finally the vaginal portion are pushed back into place. After the vagina has been completely replaced, the uterus is turned over forward, anteverted as in retroflexion, by bringing the body forward and pushing the vagina backward (p. 252). It is of the greatest importance that the uterus be restored to its normal position. Moderate grades of edema of the vaginal wall, which may interfere with replacement, are removed by massage. The most frequent obstacles to the replacement of the uterus are found in parametritic exudates, perimetritic adhesions and parauterine tumors. After the prolapse has been replaced, a better idea can be formed of the width of the introitus and the relaxation of the pelvic floor. In marked degrees of prolapse the introitus is wide enough to admit the entire hand into the vagina.

Method of Determining Whether Reposition is Possible.

Differential diagnosis. In prolapse, as in all other gynecologic conditions, the diagnosis must be based on the objective signs and not on the symptoms. The patient's statements about bearing-down pains and the sensation of swelling of the vulva are by no means typical of prolapse, as the same symptoms are sometimes complained of in vulvitis, colpitis, inflammation of the uterus and neighboring organs, and in some tumors; if at the same time a slight degree of descent is present, one is tempted to regard this as the cause of the symptoms and to overlook the other conditions.

Differential Diagnosis.

Diagnostic errors are possible even when an objective examination is made. Thus a cystocele protruding into the introitus may produce a picture very similar to that of prolapse of the vagina; such a cystocele, however, is usually situated to one side of the median line, the investing mucous membrane is greatly attenuated, the wrinkles are obliterated, and the contents of the cystocele appear as a bluish sheen in the attenuated wall. As a rule the cystocele may be recognized as a circumscribed, flabby, fluctuating tumor.

Prolapse of the posterior wall may be simulated by a vaginal septum which has been torn from the anterior wall and protrudes from

the introitus. The septum is usually narrow and like the keel of a boat, continuous only with the middle of the wall, and disappears rapidly above; while a prolapse is broader, involves the entire posterior wall, and merges above and laterally with the vagina, which is *in situ*. The presence of septal remains on the anterior wall frequently helps to clear up the picture.

A complicated picture is produced in a case of total prolapse of the vagina when there is complete atresia of the external os, as not infrequently occurs in old women; the physical signs may in such a case resemble those of an extruded myoma or an inverted uterus. Where the external os cannot be found even with the smallest-sized probe and is not revealed by a small plug of mucus, the prolapsed vagina can still be recognized by this fold and by the descent of the vaginal vault.

Prolapse is frequently confounded with elongation of the vaginal portion, particularly the so-called penis-shaped hypertrophy, which may be so great that the external os appears at or in front of the vulva; or, conversely—and this is undoubtedly a still more frequent mistake—the cervix in cases of descent of the uterus, when it is displaced downward and covered by an inverted vagina, is mistaken for an elongated vaginal portion. The points of distinction are the position of the vaginal vault, which in true elongation of the vaginal portion must be at its normal level in front and behind; the character of the mucous membrane covering the cervix, inasmuch as it is smooth and immovable when the underlying structure is the vaginal portion, whereas the presence of wrinkles and mobility indicates the beginning of a true vaginal mucous membrane.

Anteversion of the Uterus.

Since the normal uterus lies in a position of moderate anteversion, the dividing line from a pathologic anteversion is not easy to define. We speak of a pathologic anteversion when the uterine body occupies a lower position than normal on the bladder, and the vaginal portion is displaced so far upward that the external os presents directly backward or even backward and upward (Fig. 118); the uterus at the same time is usually fixed in this position. The junction of the body with the cervix, particularly in the presence of metritic processes, becomes rigid, and the cervico-corporeal angle is obliterated.

Definition and Palpatory Findings.

The diagnosis of anteversion is easy. The attention of the examiner is at once arrested by the position of the vaginal portion, which may be displaced so far upward that the os can barely be reached with the finger; the body is in close contact with the anterior vaginal vault and often causes a downward bulging of that structure.

It is important to search for the causes of anteversion. They are frequently found in a chronic metritis which has increased the thickness and weight of the uterus and caused it to drop forward. In other cases the anteversion is due to adhesions between the body or its adnexa, on the one hand, and the anterior pelvic wall on the other, drawing the uterus down and forward and fixing it in the abnormal position; or the cervix may be elevated and attached by adhesions to the posterior pelvic wall, causing the body of the uterus to drop forward.

Causes.

FIG. 118.—ANTEVERSION OF THE UTERUS. P.-F. ⅓. (Original.)

Lateroversion of the Uterus.

The normal uterus frequently occupies a somewhat oblique position so that the fundus is directed toward one side and the vaginal portion toward the other, one lateral aspect presenting forward. The term pathologic lateroversion is used only when the obliquity is very pronounced or the uterus is fixed in the oblique position; in extreme cases the uterus may occupy a completely transverse position in the pelvis (Fig. 119).

Definition.

NOTE: Schultze applies the term lateroversion only to those displacements of the uterus in which the organ is rotated around its lateral surface, and includes the oblique positions of a normally anteverted uterus among the varieties of torsion.

Lateroversion of the uterus is at once suggested by the position of the vaginal portion when it deviates markedly to one side, and the os is directed well to one side and backward; the uterine body is in the other half of the pelvis, with the fundus near the lateral wall.

The causes of lateroversion may be more difficult to discover. Congenital lateroversion is seen with double malformations of the uterus. The uterus is formed by the two ducts of Müller, which run obliquely from both sides downward to the middle of the pelvis and unite to form the single organ. If union fails to take place, the uterus consists of two oblique halves which come together at the angle. If one of the cornua remains rudimentary while the other reaches its full development,

Lateroversion in Malformations of the Uterus.

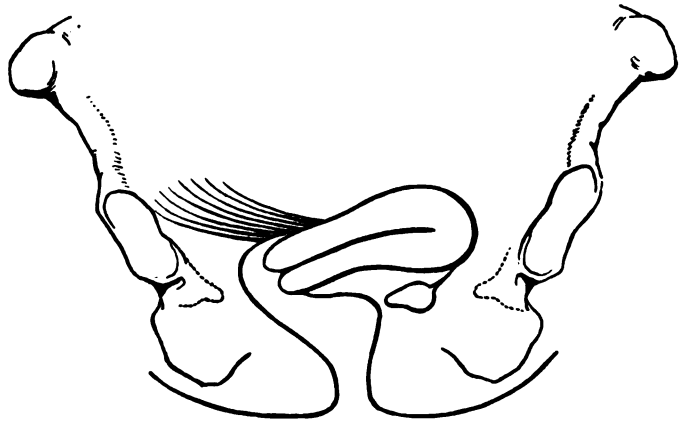

FIG. 119.—SINISTROVERSION OF THE UTERUS. P.-F. ½. (Original.) The uterus is almost transverse. The vaginal portion is fixed on the right side. The vaginal vault on the right side forms a cleft, on the left it is well developed. The left adnexa are underneath the uterus.

there results a uterus in marked lateroversion which, however, differs from all other forms of lateroversion by the perfect mobility, the absence of adnexa at the inner side (they are given off from the rudimentary cornu), and usually by the median position of the cervix. In double malformations with fully developed cornua (uterus bicornis et didelphys) also, the two cornua are more or less in a position of lateroversion.

As a rule lateroversion is acquired through inflammatory processes in the pelvic connective tissue, followed by contraction. If the connective tissue contained in Douglas' fold contracts, the cervix, and with it the body, is drawn over to the pelvic wall, because the pull is exerted so high up that the body also is affected. But if the cicatricial contraction takes place in the deeper portions of the parametrium, the cervix is drawn to one side and the body to the other: lateroversion results (Fig. 119). This variety is

Acquired Lateroversion.

easily recognized by the fixation of the cervix and the shortening of the parametrium, the mobility of the body being completely preserved. Lateroversion may also result from forces acting on the uterine body. An inflammatory process in the broad ligament or in the tissues surrounding the tubes, with contraction, or the short pedicle of an ovarian tumor may draw the body to the pelvic wall; or tumors of the adnexa or of the broad ligament may crowd the body to one side in order to gain room for their growth. As in the case of lateroposition, the tumors are usually not pedunculated and have been prevented from growing upward into the abdominal cavity. A very rare cause of lateroversion is found in tumors which push the cervix forcibly against one pelvic wall and allow the body to deviate to the other side.

Retroversion of the Uterus.

Retroversion of the uterus represents a displacement in which the body deviates backward from the pelvic axis, and the vaginal portion is displaced forward as far as, or in front of the pelvic axis. In a diagnostic sense retroversion is so closely related to retroflexion that the two anomalies will be treated together.

Anteflexion of the Uterus.

By the term anteflexion of the uterus we understand an increase of its normal curvature over the anterior surface; as this curvature fluctuates within certain limits, a slight increase over the normal angle, which is about 135°, must not be designated an abnormal angulation. But if the angle is less than 90° or, in other words, really an acute angle, the position of the uterus is called a pathologic anteflexion. This does not mean, however, that abnormal kinking of the uterus to that extent necessarily represents a disease in every instance, or that it produces definite symptoms; or, if symptoms happen to be present, that they are necessarily to be referred to the abnormal angulation. On the contrary, it must be distinctly emphasized that in the great majority of the cases the anteflexion is in itself an indifferent, and probably a secondary condition, and that the true cause of the symptoms, and frequently also the cause of the anteflexion, must be sought in the complications, such as inadequate development of the uterus or inflammatory conditions of the folds of Douglas. From this standpoint even an acute-angled anteflexion is regarded as an anomaly of practically no significance. Nevertheless it cannot be omitted altogether from the list of uterine displacements, because in a few very rare cases the abnormal angulation alone must be regarded as the cause of the clinical symptoms. Hence in the majority of cases a diagnosis of anteflexion merely indicates that the uterus is bent over for-

Definition.

ward more sharply than normal, and does not reach the true disease. In every case the physician must try to ascertain whether there are, in addition to the anteflexion, other conditions which must be regarded as the cause of the clinical manifestations.

We, therefore, divide the diagnosis of the displacement under consideration into the diagnosis of anteflexion itself and the diagnosis of its varieties or causes.

Diagnosis of Anteflexion.

The diagnosis of anteflexion of the uterus is easy if a satisfactory palpation can be made. The cervix usually has the same direction as the vagina, so that the external os is directed forward and downward and the body lies so close to the surface that the finger enters the angle with difficulty. If the body is felt through the anterior vaginal vault, the degree of anteflexion can be determined without difficulty. Care must be exercised not to alter the angle during the examination; in obtuse-angled anteflexion it is very easy to obliterate the angle or even to bring about a retroflexion. Diagnostic difficulties arise only when an anteflexed uterus is displaced so far backward that the body cannot be felt by bimanual examination, or the cervix is so long that it cannot be reached with the internal finger, or the body so small that it cannot be recognized with certainty by any means at our command. In all such cases the uterus is thought to be in retroversion on account of the position of the vaginal portion or the elongation of the cervix, which has the same direction as the vagina; nor is it in most cases possible to introduce the finger through the rectum high enough to feel the anteflexion of the uterine body. Cases of this kind are very important in practice on account of their frequency, and because, if an incorrect diagnosis of retroversion is made, the patient is subjected to a fruitless and often very distressing course of pessary treatment. If in such a case anteflexion is suspected because the fundus cannot be certainly reached through the posterior vaginal vault, or because the examiner thinks he feels the anteflexion of the uterine body at the lateral aspect, and a positive diagnosis cannot be made, he need not hesitate to resort to general anesthesia. In most cases every doubt can be cleared up under an anesthetic. In doubtful cases the necessary certainty may also be attained by means of the sound, since in retroversion it glides into the cavity in a backward and upward direction as far as the ring; while in anteflexion resistance is at once encountered at the internal os, and the instrument can be made to glide in only by giving it a sharp curve or depressing the handle, or by drawing the cervix down with a double tenaculum. After the sound has been introduced, the anteposition of the fundus may be detected by feeling the knob through the tissues in front.

Differential Diagnosis between Anteflexion and Retroversion.

Tumors placed in front of the uterus, such as a perimetritic exudate or a myoma, may be mistaken for a uterine body in anteflexion if they form the same angle with the cervix above the internal os. The distinction can always be made by noting that the shape and size of the tumor are not exactly the same as those of the anteflexed uterine body, that exudates are usually more diffuse and that, on the other hand, the body of the uterus can always be felt or demonstrated with the sound behind the tumor.

Differential Diagnosis from Ante-uterine Tumors.

FIG. 120.—CONGENITAL ANTEFLEXION OF THE UTERUS. P.-F. ⅓. (Original.) Uterus movable; acute-angled anteflexion; rigidity of the angle. Body well developed.

In several instances I have had great diagnostic difficulties to contend with when the anteflexion was associated with twisting of the uterus due to unilateral contraction of the ligaments. The body in these cases was felt so distinctly alongside of the elongated cervix that I at first mistook it for a parauterine tumor.

While the diagnosis of anteflexion in general is quite easy, great, or even insurmountable difficulties may be encountered in the effort to determine the variety, the etiology and the sequelae of this anomaly; in short, when the question whether the existing anteflexion is responsible for the symptoms or not is to be decided. The classical

symptoms of anteflexion, dysmenorrhea and sterility, are encountered in almost all of the varieties of the displacement and are, therefore, of no value for the differential diagnosis between the individual varieties. The most important point to determine is whether the anteflexed uterus is freely movable or fixed to the posterior pelvic wall by inflammatory adhesions: this question can easily be decided by a careful bimanual examination. If the uterus is found to be freely movable, the condition is

Diagnosis of the Variety and Causes of the Anteflexion.

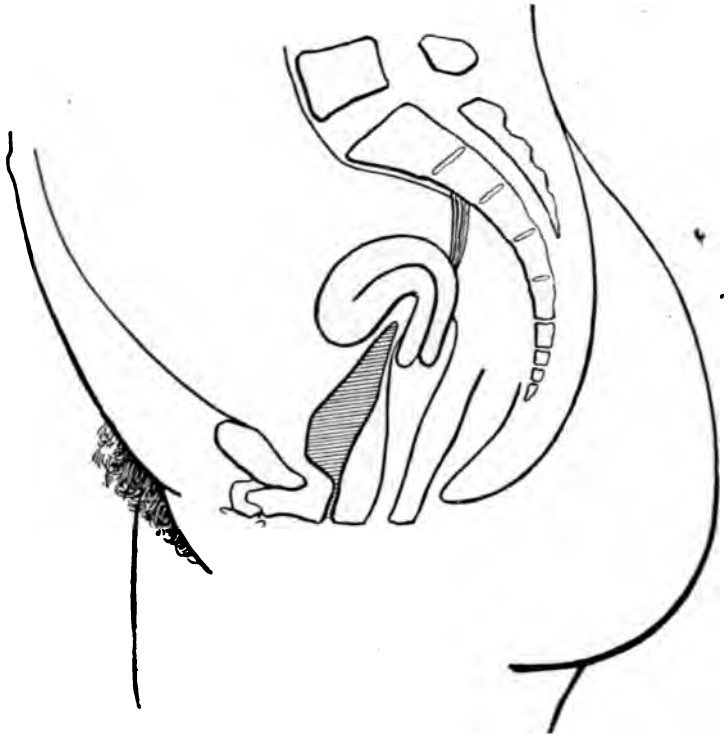

FIG. 121.—ANTEFLEXION OF THE UTERUS WITH FIXATION. P.-F. ⅓. (Original.) Anteflexion and retroposition with posterior fixation, due to posterior parametritis.

usually congenital; the angle of anteflexion is usually rigid, unchangeable, and cannot be obliterated by distending the bladder. So-called rigidity of the angle may, therefore, be regarded as another sign of congenital anteflexion (Fig. 120). There is also a congenital anomaly in which a small, flat uterus is found at the end of an elongated cervix, movable backward and forward as though it were hinged, so that anteflexion alternates with retroflexion. The uterus in congenital varieties of anteflexion is usually small and ill-developed. Simple, movable forms of anteflexion may also be acquired through disturbances of nutrition in the uterine wall, causing attenuation and softening of the wall and

angulation of the uterus; physiological examples of this condition are found in the anteflexions of the gravid and of the puerperal uterus.

In anteflexion with fixation the uterus is in retroposition and moderate elevation, and fixed to the posterior pelvic wall. This variety of anteflexion is at once suggested by a long-drawn-out vagina, a high position of the vaginal portion, and posterior displacement of the organ (Fig. 121). Direct proof of its existence is easily found in the diminished or abolished mobility of the uterus forward and the pain which accompanies the attempt to bring it forward to the anterior pelvic wall. The cause of the fixation in every instance is found in the shortening of the two folds of Douglas (parametritis posterior retrahens); the body itself is freely movable. In anteflexion with fixation the altered position is always secondary and without influence on the symptoms, the inflammatory adhesions representing the primary condition and the true source of the patient's discomfort.

The differential diagnosis between these two conditions becomes very difficult when inflammatory adhesions are superadded to a previously freely movable anteflexion.

The congenital, rigid variety is the only one that in rare cases may be regarded as the direct cause of mechanical disturbances.

Retroversioflexion.

Retroversion is an anterior position of the uterus in which the body approaches the sacrum and the vaginal portion is approximately in the pelvic axis. The uterus is usually drawn out and occasionally somewhat bent over the anterior surface. In retroflexion the vaginal portion is still nearer the symphysis, while the body is depressed farther down and backward into the hollow of the sacrum and forms with the cervix an angle presenting backward. According to this definition retroversion and retroflexion belong to different groups, but owing to their similar etiology and the numerous transitions between the two that are observed, they must be studied together. Retroversion usually represents merely a transitional stage to retroflexion, and the latter develops from the former when relaxation in the region of the internal os is superadded. Not infrequently, however, the retroversion persists either because the internal os preserves its normal rigidity (retroversion in nulliparæ), or because the uterus becomes abnormally firm through chronic inflammation of its walls, or fixed in a position of retroversion by inflammatory processes in the serous covering or in the adnexa. Definition.

Retroversioflexion is not a displacement of the uterine body alone; it involves the vagina, vaginal portion and cervix, tubes and ovaries. An accurate examination must include all these organs, particularly

as many clinical symptoms are not due to a change in the position of the uterine body alone, but are explained by the accompanying changes in the neighboring organs.

Palpation (Figs. 122, 123).—Very marked changes in the direction of the vagina occur. As the upper extremity of the vagina surrounds the vaginal portion of the cervix, it must accompany the latter in its forward movement; as a result the direction of the vagina, which in a posterior position of the vaginal portion coincides with the straight

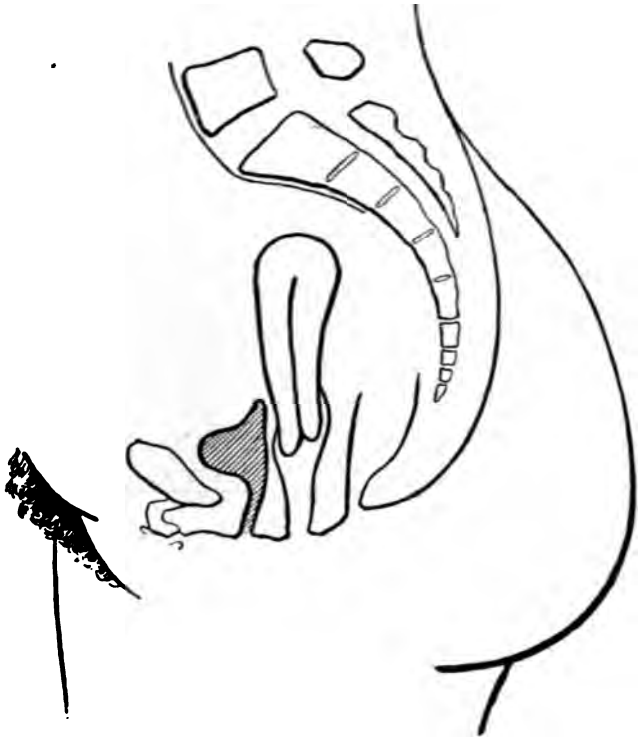

FIG. 122.—RETROVERSION OF THE UTERUS. P.-F. ⅓. (Original.)

diameter of the pelvic outlet, runs almost vertically upward behind the symphysis. As the introitus also lies much nearer the anterior pelvic wall, the vaginal vault and the introitus approach one another much more closely than is the case when the vagina is straight as under normal conditions. The vaginal tissue, being too long for the shortened distance, contracts if it has retained its normal elasticity, or—as may be observed particularly in nulliparæ—the vagina is puckered and the folds appear in the introitus. In this way there is produced the picture of a descent of the anterior wall which, in contradistinction to primary descent of the vagina (see p. 221), is designated secondary descent with retroflexion. It differs from primary descent by the fact that it

disappears completely when the uterus is replaced and the vaginal portion brought back to its normal position. The position of the posterior vaginal wall in its lower half is determined by its attachment to the rectum, while the upper half moves forward with the vaginal portion; thus an anterior flexion is produced at its middle. When the prolapse is associated with retroversion, the vagina becomes inverted from above and is thereby still more shortened.

The vaginal portion in retroversion is displaced about as far as

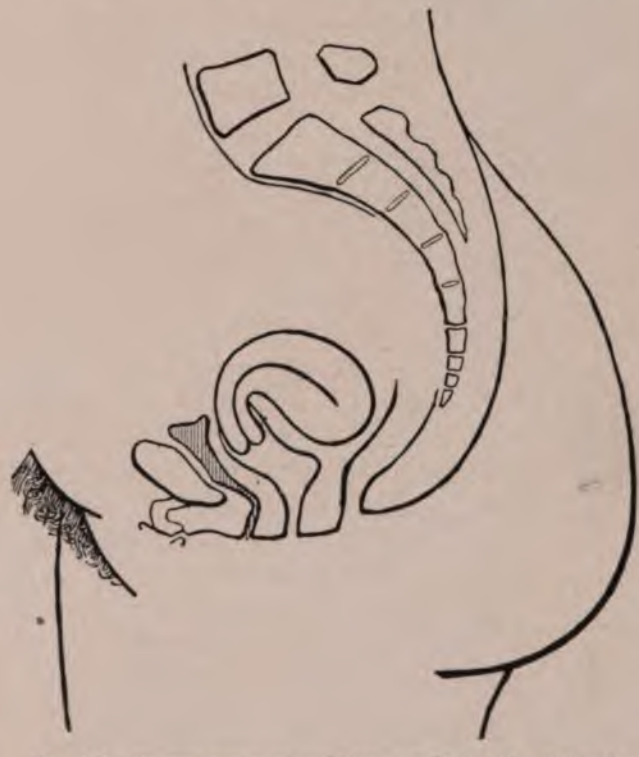

Fig. 123.—Retroflexion of the Uterus. P.-F. ⅓. (Original.)

the pelvic axis, while in retroflexion it is crowded still farther forward by the uterine body, which occupies Douglas' space. The larger the body, the nearer will be the vaginal portion to the symphysis; and in retroflexion of the gravid uterus it is found close to the posterior wall of the symphysis. If the body is deep down in Douglas' space, the vaginal portion is drawn upward and, in retroflexion of the gravid uterus, is often above the upper border of the symphysis. This upward displacement of the vaginal portion causes flattening of the anterior vaginal vault to the extent of complete obliteration of the anterior lip, while the posterior lip lies in the lumen of the vagina and often appears elongated like a pig's snout, particularly as the supravaginal portion of the

cervix is felt through the posterior vault and therefore apt to be included in the vaginal portion. The dragging on the anterior wall of the vagina causes gaping of the cervical canal and an apparent ectropion, which, however, also disappears after the uterus has been replaced. The direction of the cervical canal in retroversion forms a rectilinear prolongation of the uterine cavity. In moderate degrees of retroversion the external os presents forward and downward; but the deeper the position of the uterine body, the greater will be its displacement forward, and in the most severe grades it is even displaced upward. In retroflexion of moderate degree the os presents forward and downward, and in acute angulation of the uterus more directly downward. The closer the vaginal portion comes to the anterior wall of the pelvis, the more it also approaches the introitus; as a result it is more easily reached with the palpating finger and therefore is thought to occupy a lower level. But this descent is only apparent; for it occupies the same pelvic plane as the normal vaginal portion (about the plane of pelvic contraction), whereas true downward displacement of the vaginal portion means a descent of the structure into the pelvis, as *e.g.*, in the pelvic axis, such as occurs in prolapse associated with retroversion (Fig. 124).

FIG. 124.—APPARENT AND ACTUAL DOWNWARD DISPLACEMENT OF THE VAGINAL PORTION. Schematic. ½. (Original.) The vaginal portion in retroflexion is at the same level as that of the normally situated uterus, while in retroversion the vaginal portion is actually displaced downward on account of the existing descent.

The change in the position of the uterine body is the essential point in the physical examination. We speak of retroversion only when the body of the uterus is distinctly felt behind the pelvic axis, *i.e.*, near the promontory; between this position and retroflexion, in which Douglas' space is arched forward almost to the introitus, every possible stage may occur. I do not consider it practicable to subdivide retroflexion into its various degrees, and prefer to designate the degree of retroflexion by the sacral vertebra which corresponds to the level of the uterus. The retroflexed body is rarely exactly in the median line; usually it deviates somewhat to the left, more rarely to the right, because retroflexion is frequently associated with torsion. In retroversion the posterior wall of the uterus is in complete extension and in rare cases it is still distinctly bent over the anterior surface (Schultze's retroversio cum anteflexione). In retroflexion an angle is formed in the region of the internal os, and this may

Uterine Body.

become so acute that the body lies in contact with the posterior wall of the cervix.

In moderate degrees of retroposition of the body the ovaries retain their position at the pelvic inlet practically unchanged; if, however, the uterine body sinks deeper into the hollow of the sacrum, the ovarian ligament draws the median pole of the ovary backward, and the gland rotates around its frontal axis, but in the main retains its normal position (Fig. 125). As a matter of fact, however, the ovaries are usually found deep down in Douglas' space, because the infundibulo-pelvic ligaments (suspensary ligaments of the ovary) take part in the general relaxation of the pelvic peritoneum and permit downward displacement of the ovaries. Occasionally

Ovaries.

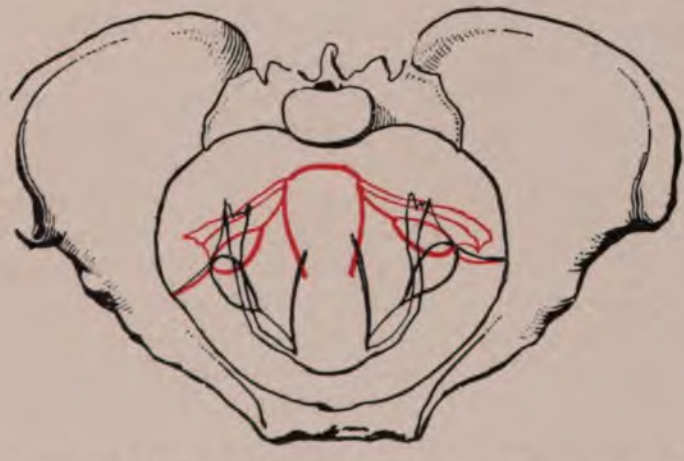

Fig. 125.—Position of the Tubes and Ovaries in Anteversion and Retroversion of the Uterus. Schematic. ⅓. (Original.)

the ovaries are placed so deeply in Douglas' space that they can be felt with the internal fingers alone on the anterior wall of the sacrum.

An important change takes place in the position of the tubes. The uterine extremity is displaced forward with the fundus; while the abdominal end, which is attached to the ovary, remains near the gland (Fig. 125). In pronounced degrees of retroflexion the tubes run from behind forward, rendering palpation of the uterine extremity and therefore the diagnosis of tubal diseases extremely difficult.

Tubes.

The degree of displacement of the bladder is determined by the position of the cervix, since it is firmly attached to that structure. As the cervix is displaced forward it draws the posterior wall of the bladder with it and produces an invagination; and in retroflexion of the gravid uterus, in which the cervix becomes greatly elevated, it carries the bladder with it so that the floor of the viscus is very much displaced upward and the urethra is long drawn out in length.

Bladder.

The rectum suffers invagination in cases of retroflexion particularly when the uterus is enlarged, and a moderate narrowing of the rectal tube may result.

Diagnosis. The diagnosis in retroflexions must include the following points:

1. The displacement of the uterus and the secondary effect on the neighboring organs.

2. It must be ascertained whether complications are present and what relation they bear to the retroflexion.

3. If it is contemplated to restore the uterus to its correct position, it must be determined whether the uterus is movable or fixed and what kind of fixation is present.

The diagnosis of the displacement is based on the above-mentioned palpatory findings, among which the position of the body of course occupies the most prominent place. An inkling of the position of the uterine body may be gained from the position of the vaginal portion; if the latter is in the pelvic axis and the os is directed forward and downward, the uterus is usually in retroversion, but may also be in anteflexion. If the vaginal portion is anterior and the os is directed downward, the uterus is in retroflexion or in anteposition. The distinction between the two positions in each instance can be made only by ascertaining the position of the body, which is most easily accomplished by bimanual palpation. But, as in many cases of retroflexion the examining hand is unable to reach the uterus when it is low down in the hollow of the sacrum on account of the thick abdominal walls and the intestines, it would be impossible to make a diagnosis in such cases were it not that the condition can also be recognized with a fair degree of certainty with the internal finger alone, provided, of course, the vaginal wall does not offer too much resistance and the uterus occupies a fairly low position. Under these circumstances there is felt a circumscribed resistance of the size and shape of the uterus, which makes an obtuse angle with the cervix; palpation of this intermediate portion is difficult when the cervix is very slender and the cervico-corporeal angle is acute. The retroflexed uterine body can be detected still better through the rectum; position, shape, consistency, and connection of the cervix are readily made out by palpation through the softer rectal wall. If this method also fails and the uterus cannot be reached either with the external, or with the internal hand, a cautious attempt may be made with the sound: the position of the uterus is recognized by the direction which the instrument assumes. In very difficult cases anesthesia is the last resort. I have once or twice seen cases in which a retroversion was overlooked or incorrectly interpreted because the internal fingers were not pushed up sufficiently high through

Diagnosis of the Displacement.

the posterior vaginal vault, and the external hand, placed on the anterior wall of the retroverted body, mistook that region for an anteriorly directed fundus.

Differential diagnosis. The diagnosis of retroversioflexion is quite easy, provided the uterus can be felt. As, however, this is sometimes difficult on account of the deep position of the body, mistakes are not infrequent. Among my own students the commonest is that a retroflexion is mistaken for a retroposition. Aside from the fact that a number of errors have arisen from a confusion of the two definitions (Fig. 126) and that the pathologic conception of retroposition is not sufficiently familiar to practitioners, diagnostic errors are usually due to the fact that the physician promptly assumes that he is dealing with a retroflexion if he fails to find the uterine body in front in its normal position. This negative conclusion is not justified. The position of the vaginal portion in the posterior half of the pelvis alone usually is against retroflexion; and if the internal fingers are pushed up through the anterior vaginal vault, the anterior curve of the uterus is felt in cases of retroposition (the curving of the urethra over its anterior surface), while retroflexion may be assumed to be present only when the body can be felt or demonstrated with a probe in the posterior vaginal vault.

Differential Diagnosis.

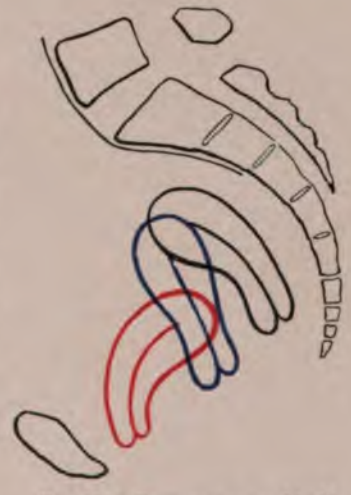

Fig. 126.—Retroposition (black), Retroversion (blue), Retroflexion (red) of the Uterus. Schematic. (Orig.)

Retroversion and anteflexion are frequently mistaken for one another, particularly in the comparatively frequent cases in which the cervix is elongated and the uterine body small and atrophic. The position of the vaginal portion is the same in both displacements, and as a large part of the supravaginal cervix can frequently be felt through the posterior vaginal vault, it is easily mistaken for the entire uterine body, particularly as the small atrophic uterine body cannot be positively identified in front. The best way to guard against this error is to feel along the lateral aspect of the uterus and note the anterior curve (anteflexion), or demonstrate the direction of the uterine cavity with the sound.

Retroversion and Anteflexion.

Retro-uterine tumors may be mistaken for retroflexion of the uterus if they are not in close apposition with the posterior vaginal vault, or if they are connected at the angle with the posterior wall of the cervix and crowd the latter forward. Errors of this kind occur in

cases of subserous myoma, parametritic exudates, or the remains of hematoceles and exudates in Douglas' pouch. The secret of differentiating between these two conditions consists in demonstrating the position of the uterus either by palpation or by the cautious use of the sound, as in the case of myomata. In cases of exudate and hematoma the shape and attachment of the tumors may aid the diagnosis; they are usually broader than the uterus; situated not only directly behind the cervix, like the retroflexed uterine body, but also to one side; and become narrower as they approach the pelvis, to which they are attached. Rectal examination in these cases affords the most certain means of arriving at a correct diagnosis.

Retro-uterine Tumors.

Diagnosis of Complications. The objective demonstration of retroflexion of the uterus and the associated changes in the position of the adjacent organs does not suffice for a full understanding of the clinical picture. In retroflexion, more than in any other gynecologic disease (see p. 70), it is necessary to ascertain whether the symptoms on account of which the physician is consulted can be attributed to the local disease or whether they possibly owe their origin to an entirely different affection, the retroflexion representing merely an indifferent accessory condition. The answer to this question must depend on the account which the patient gives of her symptoms.

Diagnosis of Complications.

The question which has to be decided most frequently is whether the retroflexion which has been discovered at the examination is to be regarded as the cause of the pains described by the patient as dragging sensations in the sacrum, the flanks, the abdomen and the entire back, as far up as the interscapular region, in the rectum in the form of pains accompanying defecation, during manual labor, when the patient is walking, or as a downward pressure, weakness, and the like. The cause of these painful sensations is usually found in inflammatory conditions of the adnexa, in the parametrium and perimetrium. Very careful combined examination is necessary to detect delicate changes in the adnexa, because in retroflexion they are low down in the hollow of the sacrum. It is still more difficult to demonstrate the presence of perimetritic inflammations and adhesions. An important diagnostic point is that in simple retroflexion cautious palpation is not attended with pain. Pain elicited by combined examination, whether it be by pressure on the vaginal portion or vagina, or by displacement of the uterus, should therefore suggest the existence of a complicating inflammation. A positive diagnosis cannot as a rule be made until the uterus has been replaced. When the uterus lies in its normal position, it is possible to demonstrate minute changes in the adnexa as well as adhesions of these organs or perimetritic bands. This rule is still more

important in the diagnosis of parametritis with adhesions (parametritis retrahens), which as a rule produces only painful thickening of the two folds of Douglas and adjoining connective tissue, and the only physical sign elicited by palpation is the presence of a few painful adhesions. As the latter are always hidden underneath the retroflexed uterus, they cannot be felt unless the uterus is elevated. After retroposition has been effected, the entire posterior parametrium can be palpated with certainty and, to the examiner's astonishment, the true cause of the pain is then discovered. This association of posterior parametritis with retroflexion is the most frequent cause of sacral and dorsal pains and the sensation of pressure in the rectum. It is only by making it a rule always to make a second careful bimanual examination of the tissues surrounding the uterus, and particularly of the parametrium, after the uterus has been elevated that the true cause of the symptoms can be recognized with certainty in every instance. These inflammatory changes bear a close relationship to retroflexion of the uterus, inasmuch as the pain is directly produced by the pressure of the uterus on the inflammatory adhesions. If no inflammatory conditions of any kind are present and the symptoms cannot be explained by some other abdominal disease or by a neurosis, then and only then, in the few remaining cases, the displacement itself may be regarded as the cause. In practice the greatest degree of accuracy will in general be attained if the physician makes it a rule not to associate abdominal pain with uncomplicated retroflexion of the uterus.

With regard to the bladder symptoms also, it must be borne in mind that retroflexion of the uterus as such can produce them only when the displacement is associated with a marked distortion of the floor of the bladder. This is the case only when the vaginal portion is in immediate contact with the symphysis or greatly elevated by the depressed uterine body. Distortion of the floor of the bladder occurs only when the uterus is enlarged either by a myoma or by abnormal contents, and particularly in retroflexion of a gravid uterus; there is a very close connection between this condition and the bladder symptoms. In simple, uncomplicated retroflexion of the uterus there is no reason to assume that the displacement is responsible for the bladder symptoms. Whenever there are pronounced bladder symptoms, particularly when there is great tenesmus, a careful examination of the centrifugated sediment of the urine and, if that proves negative, cystoscopic examination of the bladder must be made. If neither of these examinations gives a positive result and there is no ground for supposing that the frequent micturition is due to neurasthenia, as is so often the case in the female sex, one is justified in regarding the retroflexion as the cause. Such cases are extremely rare.

The mucous membrane symptoms—vaginal discharge and hemorrhage—which are not infrequent in retroflexion of the uterus, are usually symptoms of a complicating catarrh due to chronic gonorrhea or some other bacterial infection. Menorrhagia usually finds its explanation in a complicating endometritis or in chronic atonic conditions of the uterus; but it may also be the result of the congestion that occasionally accompanies retroflexion.

With regard to dysmenorrhea and sterility, it is only in the case of nulliparæ with acute-angled retroflexion that one is justified in assuming that the angulation at the internal os is interfering with conception or presenting an obstacle to the escape of the menstrual blood. In view of the many possible causes of these two conditions it is necessary to exclude all other etiologic factors before one is justified in attributing the disturbance to retroflexion of the uterus.

Nervous symptoms, cephalalgia, pain in the stomach, respiratory neuroses and other symptoms of local and general neuroses, must not be attributed without further investigation to a retroflexion if the latter produces no local symptoms. When, however, retroflexion is complicated with inflammatory affections or catarrh, a direct connection between the above symptoms and the retroflexion may occasionally be established.

Special importance attaches to the complication of retroflexion with pregnancy—retroflexion of the gravid uterus. In the first two months of pregnancy it is frequently overlooked because enlargement and softening are not easily recognized on account of the extreme posterior position of the uterus, making it practically inaccessible to combined examination. During the third and fourth months, the period when retroflexion of the gravid uterus most frequently comes under the physician's observation on account of symptoms of beginning incarceration that appear in the bladder, the palpatory findings become characteristic (Fig. 127). The flabby, cystic tumor of variable size, which corresponds to the greatly distended urinary bladder, first attracts attention, and it is only after the urine has been evacuated that the physical signs can be determined by palpation. In the vagina and vaginal portion the signs of pregnancy are usually quite distinct; the vaginal portion is in close contact with the symphysis and at a high level, with the os directed downward. The posterior vaginal vault is forced downward, in extreme cases almost to the introitus, by a uniformly round tumor, which may fill the entire true pelvis. The uniformly round shape of this tumor and its close apposition to the pelvic wall are best determined by a rectal examination. The consistency of the tumor is soft and, if there is incarceration, may be even tense and elastic. The shape and consistency of the tumor alone suggest the

probability of a pregnant retroflexed uterus, but the diagnosis becomes positive only after the symmetrical junction of the vaginal portion with the body has been demonstrated by combined palpation through the posterior vaginal vault and the abdominal walls. As this junction is usually very soft and loose it is sometimes difficult to palpate, and one is apt to fall into the error of mistaking the hard cervix in front, particularly if it is somewhat elongated, for the entire uterus, and the soft uterus deep down in Douglas' space for a tumor behind the uterus.

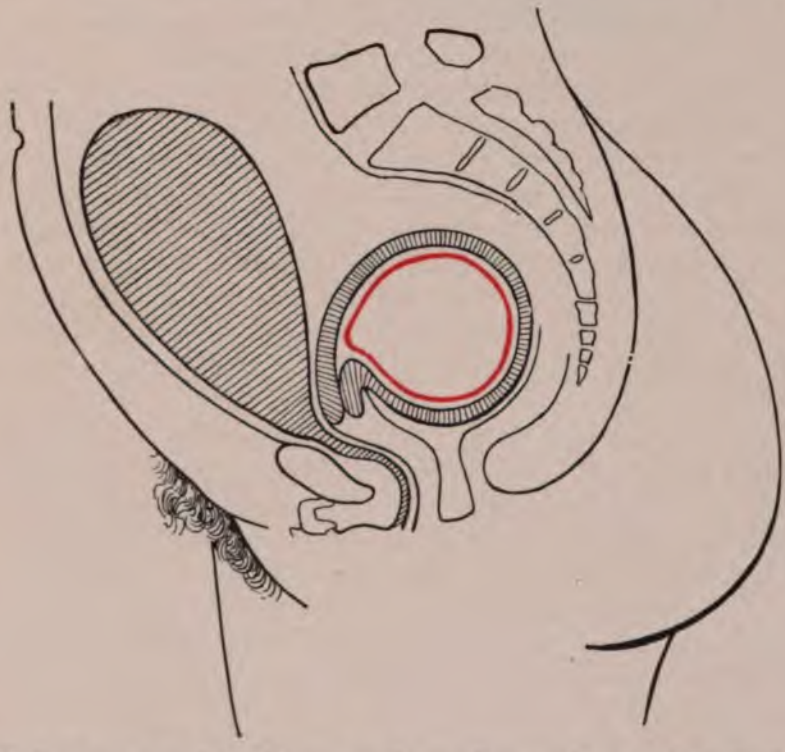

Fig. 127.—Retroflexion of Gravid Uterus with Greatly Distended Bladder. P.-F. ⅓. (Original.)

Hence retroflexion of a gravid uterus is most frequently mistaken for a retro-uterine hematocele (differential diagnosis, see p. 167), retro-uterine perimetritic exudates (q. v.), or a retro-uterine ovarian tumor (q. v.).

Diagnosis of Fixation. If, after a careful study of the clinical picture as a whole, the physician arrives at the conclusion that a permanent correction of the retroflexion is indicated, the first thing to be determined is whether the uterus can be drawn into its normal position, *i.e.*, whether the retroflexion is movable or fixed. A retroflexed uterus is called movable only when it can be completely anteverted and retains its anterior position for a considerable space of time, until finally it is forced over backward again, pos-

Diagnosis of Fixation.

sibly by filling of the bladder or straining at stool; it does not suffice for a definition of mobility that the organ can be pushed freely from side to side or moved about in the pelvis. The uterus is said to be fixed when it is so firmly attached to the pelvic wall by inflammatory products of various kinds that it cannot be elevated at all or only a very short distance, or when the uterus, although it may be possible to bring it into complete anteversion, is at once drawn back as soon as it is released. The condition in which the uterus is merely held fast in the pelvic cavity by its size (pregnancy, myoma) is called incarceration and not fixation. Hence, in order to make a diagnosis of fixation it is necessary to replace the uterus in its normal position. Reposition of the uterus, the main object of which is to demonstrate that the fixation is the result of inflammatory processes, should therefore not be performed in the presence of recent or very painful processes, because the attempt to elevate the organ may increase the inflammation. The procedure is also contraindicated in the presence of inflammatory tubal affections, whereas in chronic parametritis and perimetritis not associated with severe pain reposition should be effected without hesitation.

In performing manual reposition the woman is placed in the coccygeo-dorsal position, after bladder and rectum have been completely evacuated. Two fingers are introduced into the posterior vaginal vault, and the uterus is elevated if possible as far as the promontory, or to one side past the promontory, the external hand in the mean time making deep pressure on the abdomen and attempting to grasp the fundus. After the external hand has succeeded in grasping the fundus, the internal fingers are changed from the posterior to the anterior vaginal vault, and the vaginal portion is pushed backward, while at the same time the uterine body is pulled down to the bladder by the external hand. Quite often the body drops back again at the instant when the fingers are removed from the posterior vaginal vault, because the external hand is unable to obtain a firm hold of the fundus. Sometimes, particularly if the uterus is very rigid, the body can be elevated indirectly by making pressure on the vaginal portion from the front; but even in cases of marked flexion it is sometimes possible to push the cervix upward and with it the overlying uterine body. The greatest difficulties encountered in reposition are the thickness of the abdominal walls and the sensitiveness of the patient. If elevation is prevented by the tension of the posterior vaginal vault, it may sometimes be effected through the rectum by introducing the index finger and elevating the body, while at the same time the vaginal portion is pushed backward with the thumb introduced into the vagina. Manual reposition requires

Manual Reposition.

practice and skill, and the general practitioner, whose experience is generally limited, will meet with failure in many cases, and this will lead him to conclude that the uterus is fixed. But this is by no means the case. A diagnosis of fixation is justifiable only after all the various methods of reposition have been tried and failed.

If after a few cautious trials it is impossible to replace the uterus by manual reposition, the attempt should be abandoned and elevation with the sound tried instead. If the instrument is used with care, no harm will be done and elevation of the uterus will be effected much more easily and with much less pain to the patient than by unskilful manipulation. While abrasions of the mucous membrane and a little bleeding may possibly occur, I have never seen gross alterations of the parenchyma or perforations of the uterine wall. The sound should have a flat curve and be provided with a large knob. It is introduced as described above into the retroflexed uterus, rotated so that the concave side comes in contact with the anterior uterine wall, and the handle strongly depressed on the perineum. By this manœuvre a movable uterus is elevated sufficiently so that it can be grasped from the outside with the (right) hand and drawn down to the bladder, while with the (left) hand the sound is held in place within the uterus. After the uterus has been drawn forward, the vaginal portion is pushed back with the two internal fingers, and the sound withdrawn. If the uterus is fixed, elevation is almost or quite impossible, and the attempt at reposition causes pain by pulling on the adhesions. Short tense adhesions are recognized by the resilient character of the resistance encountered by the sound during reposition. In those cases in which the sound, as it is held in the fingers, continually tends to rotate so that the concavity of the instrument presents backward or, in other words, tends to return to the position of retroflexion, it may be assumed as very probable that the uterus is fixed.

Replacement of the Uterus with the Sound.

Instead of using the sound, reposition can also be effected in the following manner: The anterior lip is seized with a Muzeux tenaculum and forcibly drawn forward and downward; at the same time the body is elevated as far as possible either with the index finger of the left hand introduced into the rectum or with two fingers in the posterior vaginal vault; the vaginal portion is then pushed backward with the tenaculum, the handle of which is elevated toward the woman's abdomen. Occasionally replacement can be effected by this method with remarkable ease (Küstner).

Replacement by Traction with Muzeux Tenaculum.

If the use of the sound is contraindicated or the procedure fails for technical reasons, *e.g.*, in nulliparæ, manual reposition can be effected

under general anesthesia. This is undoubtedly the least harmful method to the genitalia and, in addition, offers the best possible means of detecting adhesions by direct palpation.

Determining the Kind of Fixation Present.

It is not enough merely to determine that fixation is present; one must also investigate the character of the fixation. From the standpoint of treatment this is the most important part of the diagnosis. The following varieties of fixation are distinguished:

1. Intraperitoneal or perimetritic fixation. In this form the fixation is due to peritonitic adhesions which may develop wherever the uterus is covered with peritoneum. They are found most

Perimetritic Fixation.

frequently on the posterior wall, as far up as the fundus, or on the lateral aspect near the diseased adnexa, in which these inflammatory processes usually have their beginning. The adhesions may consist of solitary bands or flat membranes of varying length. Sometimes a perimetritic adhesion, if associated with contraction and obliteration of the peritoneum, or if it represents the remains of an inspissated hematocele or exudate, may cement the uterus so firmly to the pelvic wall that the organ is absolutely immovable. In most cases, however, the adhesions consist of solitary bands and membranes, which still permit a certain degree of mobility and not infrequently allow the uterus to be completely replaced. Their perimetritic character is recognized by the fact that they are attached to those parts of the uterus which are covered with peritoneum, and by their irregularity and great tenuity, so that they often tear at the lightest touch.

2. Parametritic fixation may lead to permanent retroversioflexion in two ways: either by a firm attachment of the cervix to the anterior wall of the pelvis, in the form of contracting

Parametritic Fixation.

exudates of the anterior parametrium or bands of cicatricial tissue, the remains of lacerations; or fixation may occur at the posterior pelvic wall, if a pull is exerted on the body from behind. The adhesions resulting from old exudates in the posterior portion of the broad ligament, or underneath the detachable part of the peritoneum, attach themselves so high up on the body that a backward pull is exerted principally on this portion of the uterus. Occasionally the contracted folds of Douglas alone may produce a permanent retroversion, if they are attached unusually high on the posterior wall of the uterus; this is observed with special frequency in nulliparæ. Large parametritic exudates developing during an existing retroversion also lead to fixation. The diagnosis of parametritic fixation rests on the demonstration of an exudate or solitary bands of adhesions somewhere in the connective tissue surrounding the uterus, while the organ itself,

wherever it is covered with peritoneum, and the entire space of Douglas, are free from adhesions. Parametritic adhesions are much thicker and firmer than perimetritic bands.

3. Indirect fixation from disease of the adnexa is quite frequently observed. The adnexa become adherent to the posterior pelvic wall and hold the uterus fast on both sides, while the uterine body itself is not necessarily fixed. The diagnosis of this variety of fixation is based on the demonstration of adherent tumors of the adnexa, which often have such a broad connection with the body that it is difficult to differentiate between the two structures.

Indirect Fixation by Diseased Adnexa.

A rare cause of permanent displacement of the uterus is abnormal shortness of the anterior vaginal wall, as a result of which the vaginal portion is fixed near the anterior pelvic wall and the uterus thereby brought into a permanent position of retroversion. The attempt to push the vaginal portion back for the purpose of replacing the uterus is only partially successful and the structure comes forward again as soon as it is released. This primary shortening of the anterior vaginal wall may be congenital or due to senile shrinking. It must not be confounded with secondary shortening, which is produced in retroversion of the uterus by elastic contraction of the anterior wall; in the latter case the uterus can usually be replaced.

Abnormal Shortness of Anterior Vaginal Wall.

Torsion of the Uterus.

Torsion is rotation of the uterus around its long axis. It may occur either in the vagina, causing rotation of the entire uterus around its axis, or in the substance of the uterus itself, either in the region of the internal os or above the os, in the body; in the latter case the lower segment of the uterus remains in place and the body alone becomes twisted.

Torsion occurs most frequently in connection with anteflexion and is due to contraction of the folds of Douglas on one side, drawing one of the lateral aspects of the uterus backward. In a similar manner the uterine body in retroflexions is found displaced to one side, usually the left, as a result of torsion, and not directly backward. In uterus bicornis the organ is usually twisted so that one cornu is directed forward and the other backward. The diagnosis of these torsions, which always affect the entire uterus, is based on finding that the surfaces of the organ, instead of presenting exactly forward and backward, have a slight lateral deviation. On inspection with the speculum the external os is frequently found to be oblique or even in the sagittal plane.

Torsion in the substance of the uterus itself is produced by the growth of subserous myomata, or ovarian tumors with short pedicles. The diagnosis is never made unless it be by accident, usually from the position of the adnexa. In most cases it is made by inspection during operation.

Inversion of the Uterus.

From a gynecological standpoint we are interested in two varieties of inversion,—chronic puerperal inversion and inversion of the uterus by tumors.

FIG. 128.—TOTAL INVERSION OF THE UTERUS FROM THE BIRTH (EXPULSION) OF A SUBMUCOUS PEDUNCULATED MYOMA. ⅓. (Original.) The uterus and the submucous myoma are gangrenous; on the left a tubal orifice is visible.

Chronic Puerperal Inversion.

In chronic puerperal inversion the wall of the uterine body at the fundus is invaginated into the cavity. The inverted portion may extend only to the internal os; or the inverted uterine body may protrude into the cervix, or through the latter into the vagina; or the cervix—at least its upper segment—also takes part in the inversion. The region of the external os is usually not affected. The invagination produces above an inverted funnel of variable depth, which receives the adnexa of both sides. On vaginal examination of the inverted uterus a soft, polypoid body is found, conical above and disappearing in the external os. By intro-

ducing the finger into the external os the junction between the inverted and unaffected portion of the cervix can be demonstrated around the entire periphery; this reflexion-fold above the external os may often be made to disappear by drawing the inverted uterus downward and thus completing the inversion of the cervix. If the junction of the inverted uterus with the cervix cannot be positively recognized with the finger, it may be demonstrated with the sound, which meets with the resistance of the inverted cervix at every point on the neck of the polyp and nowhere enters the uterine cavity. Some characteristic points are also observed on inspection with the speculum: the surface is smooth, velvety, glistening and intensely red; occasionally the two tubal orifices may be seen as small retractions at the lower extremity of the tumor.

Although in favorable cases inversion of the uterus can be recognized in this way by vaginal examination alone, so much depends upon the diagnosis that an accurate bimanual examination should always be made, preferably through the rectum and abdominal walls. The absence of the uterine body can at least be demonstrated without any difficulty by this method, and if the abdominal walls are not too rigid, it is possible to recognize the inversion at the site of the missing uterus as a distinct fossa or depression which receives the extremities of the tubes, while the ovaries are usually found at the edge.

Differential diagnosis. The only condition with which inversion of the uterus may be confounded is a submucous uterine myoma lying in the vagina (for the differential points between the two see p. 282).

The diagnosis of inversion in the presence of a uterine tumor can be made only if the myoma along with the inverted uterus lies in front of the vulva. If the tumor is attached by a pedicle to the inverted uterine wall, the two can be distinctly differentiated by feeling a constriction or a ring (Fig. 128); but if the tumor is attached to the uterus by a broad base, the two structures merge into one another, and it is occasionally possible to differentiate them only by detecting a distinct difference in consistency, the uterine body being softer than the myoma. In these cases also an attempt should be made by combined examination through the abdominal walls to demonstrate an inversion-funnel; if the uterine wall is only partially inverted by the tumor, the examination is, however, not likely to prove successful.

Inversion with Tumors.

Andruszat found that among 45 cases of total inversion due to myoma, only 2 were not recognized before operation; while in 9 out of 15 cases of partial inversion no clinical diagnosis was made.

Diagnosis of Uterine Myomata.

The diagnosis of myoma presupposes a familiarity with the topography of the various developmental forms of this tumor, and of at least equal importance is a knowledge of the peculiarities which the tumor presents on palpation and which are due to its anatomical structure. For this reason I shall first give a description of the topography and special features of myomata, before discussing the diagnostic principles on which the recognition of these tumors is based.

Topography of Myomata.

Uterine myomata are circumscribed neoplasms of the uterine muscle; they usually begin as multiple tumors, but only a limited number of them undergo further development. In most cases there is one large myoma with a few smaller ones grouped around it, usually situated within the capsule of the large tumor. In other cases there may be a conglomeration of myomata grouped around the uterus; absolutely solitary myomata are rare. All myomata are primarily interstitial; but owing to the various directions in which the tumors grow, a number of clinically and anatomically distinct varieties are produced.

Topography of Myomata.

In the **uterine body** we distinguish the following:

1. **Subserous myomata.** A myoma is called subserous when it grows out of the outer wall of the uterus at a point which is covered with serous membrane. The difference between subserous and interstitial myomata is that in the former the greater portion of the circumference of the tumor is outside of the uterine wall and has no thick mantle of uterine muscle (Figs. 129 and 130). Small myomata produce a nodular thickening on the outer surface of the uterus; the larger ones are independent tumors, with a more or less broad surface of attachment to the uterine wall. As a subserous myoma increases in size it grows farther and farther away from the uterine wall, to which it is attached only by a pedicle. If the pedicle is very broad it is usually formed by part of the myoma; smaller pedicles contain only muscle tissue; a very small pedicle may occasionally be composed of nothing but peritoneum and blood-vessels; complete detachment of the pedicle occasionally occurs.

Subserous Myomata.

When a subserous myoma grows from the lateral aspect of the uterus it gets in between the two layers of the broad ligament and is called an intraligamentary myoma. This variety may also become entirely detached from the uterus and occupy the broad ligament as an

isolated tumor. When a subserous myoma originates in the lower portion of the uterine body, where it is covered with loosely attached peritoneum, it elevates the peritoneum and continues to grow underneath the membrane. This variety is called subperitoneal, in contradistinction to subserous myoma. Posteriorly such tumors may elevate the peritoneum lining Douglas' space and the posterior wall of the pelvis, coming in contact with the posterior wall; in front they get underneath the peritoneal lining of the vesico-uterine excavation and displace the bladder. Myomata originating more in the lateral portions of the anterior and posterior walls get into the broad ligament underneath the cecum and sigmoid flexure. When the pedicle is thin, the uterus retains its shape except at the point where the pedicle is attached; the organ is, however, generally somewhat elongated and thickened from muscular hypertrophy. The cavity is altered only when part of the myoma still occupies the wall; in pedunculated tumors it is merely somewhat elongated according to the lengthening of the entire uterus (Fig. 147).

Fig. 129.—One Subserous and Two Interstitial Myomata of the Uterus. ⅓. (Original.) (From a specimen in the Kgl. Universitäts-Frauenklinik in Berlin.)

2. **Interstitial** (intraparietal, intramural) **myomata** still occupy the wall of the uterus, are everywhere surrounded by a mantle of uterine muscle and project only a little beyond the outline of the organ; they cause enlargement in all dimensions of the wall which they occupy, while the sound wall is distended both in length and breadth and often considerably diminished in thickness. Interstitial myomata cause a general enlargement of the uterus which may be as uniform as that of the gravid uterus (Fig. 131), although as a rule the affected wall bulges somewhat. Owing to the hypertrophy of the muscular tissue surrounding the myoma the external contours of the tumor are somewhat rounded. The uterine cavity undergoes many

Interstitial Myomata.

changes in interstitial myoma. The distention on the side of the myoma causes a marked increase in the length and width of the affected wall. The cavity is very much displaced eccentrically, being very close to one wall of the uterus and separated from the other by the entire thickness of the myoma. If the tumor projects into the cavity, the latter becomes somewhat curved (Fig. 147).

3. **Submucous myomata** are tumors which grow toward the uterine cavity so that about one-half their circumference projects into it. The inner surface is covered only with mucous membrane or at the most with a very thin mantle of muscle tissue (Fig. 132). In the course of their growth they encroach still further on the uterine cavity and produce a uniform distention of the uterus so that the shape sometimes becomes entirely spherical. The uterine wall becomes uniformly thin except at the base of the tumor. The extent of the attachment to the uterine wall is very variable; when it is broad, it is formed by the myoma itself; smaller attachments consist entirely of muscular tissue. The greatest changes produced by submucous myomata are found in the cavity, which becomes longer, broader and, in the case of myomata with slender pedicles, completely surrounds the tumor, which lies almost free in the cavity (Fig. 147).

Fig. 130.—The Same in Sagittal Section. ⅓. (Original.)

By pressure on the inner surface of the uterus and on the internal os submucous myomata excite reflex uterine contractions, which may produce considerable changes in the position of the tumor. The internal os dilates, and the top of the tumor enters and dilates the cervix: the tumor then reaches the external os, which it also dilates even to the extent of complete obliteration, and enters the vagina. Here the tumors are usually arrested or occasionally, under the influence of vigorous abdominal pressure, may be forced down in

Birth of a Myoma.

front of the vulva. This change of position—the birth of the myoma—is possible only if the pedicle becomes greatly distended. These myomata are called fibrous polyps (Fig. 134). The birth of a broadly sessile myoma is followed by partial inversion of that portion of the uterine wall in which the myoma originates. The great stretching of the pedicles, which contain the nutrient vessels, leads to anemic necrosis and, with the coöperation of the vaginal micro-organisms, to complete disintegration of the tumor.

In all varieties of myoma, and most frequently in the submucous and interstitial, the mucous membrane of the uterine body is in a condition of extreme inflammatory thickening showing the type of glandular and interstitial endometritis.

Fig. 131.—Interstitial Myoma of the Posterior Wall. ⅕. (Original.) (From a specimen in the Kgl. Universitäts-Frauenklinik in Berlin.)

Cervical Myomata. This variety is much more rare. Most of the myomata found in the cervix have their origin partly in the body and partly in the cervix, or they begin in the body and slowly grow into the cervical wall. Pure cervical myomata are rarely seen; they are also subdivided into the three varieties which are described above.

Subserous cervical myomata in the narrow sense of the term do not occur, as the cervix is nowhere covered by firmly adherent serous membrane. Myomata originating in the outer surface of the cervix always become subperitoneal or intraligamentary, are always surrounded by pelvic connective tissue, and covered with peritoneum only on their upper surface. They displace the adjacent organs (ureter, bladder, rectum) and push the body of the uterus upward to a position at the upper pole of the tumor (Fig. 135).

Interstitial cervical myomata (Fig. 136) distend the wall in which they are lodged in all directions, while the opposite wall becomes greatly attenuated, drawn out, and surrounds the affected wall in the form of a crescent. As a result the external os is greatly distended in the transverse direction.

Submucous myomata which grow toward the cervical canal early become pedunculated and make their appearance in the external os in the form of fibrous polyps; those which develop in the vaginal portion grow toward the vagina (Fig. 137).

Combinations of several myomata belonging to different forms are frequently seen: subserous, interstitial, submucous, corporeal and cervical myomata develop side by side. Every myoma exhibits the above described changes, and the picture as a whole may be very complicated.

Palpatory Properties of Myomata.

These are properties which myomata present on palpation as a result of their anatomical structure and their connection with the parent organ. I shall here discuss only those changes which are of real value for the clinical diagnosis.

Fig. 132.—Submucous Myoma in the Cavity of the Uterine Body. ½. (Original.) (Specimen in the Kgl. Universitäts-Frauenklinik in Königsberg.)

Shape. Myomata are round, rarely oval and, as their growth is concentric, they in the main retain this shape. The true myoma shape is least conspicuous in the interstitial variety because the tumor is entirely surrounded by a mantle of muscle tissue. The typical spherical shape, with smooth surface, is best seen in subserous myomata; but these again present most variations from the typical form because they not infrequently develop the characters of an independent tumor. In that case they become oval, lobulated and divided into large segments, and the surface is not infrequently mammillated or nodular. Submucous myomata are also spherical in shape so long as they are within the uterus; but under the influence of the uterine contraction when expulsion begins, some remarkable changes in shape are produced; the tumors are drawn out in length and adapt themselves to the shape of the uterine and cervical cavities, frequently exhibit constrictions produced by the os, and become long and thin like polyps. Subserous myomata undergo a remarkable change of shape during pregnancy; they are drawn out in a transverse direction by the distention of the uterus and, instead of forming a round protuberance, merely represent a flat thickening of the uterine wall.

Shape.

Consistency. From a diagnostic standpoint this is unquestionably the most important property of myomata. It depends on the compo-

sition of the tumor, the proportion of the two fundamental substances—connective tissue and muscle; the more connective tissue, the harder the myoma, and the more muscle, the softer the tissue. Consistency.

Pure fibromata, particularly if they are subserous, may feel as hard as stone; while a pure myoma may be as soft as a gravid uterus. The latter are often impressible (doughy) and give apparent fluctuation. The thicker the layer of uterine muscle overlying the myoma, the softer will be the consistency. Most myomata are hard, unyielding and distinctly firmer than healthy uterine muscle. Before menstruation myomata undergo a characteristic change in consistency, becoming softer on account of the greater vascularity of the tissues; after the completion of the menstrual flow this temporary softness is replaced by the usual hard consistency of the tumor.

Fig. 133.—Submucous Myoma in Process of Expulsion. ½. (Original.) (From a specimen in the Kgl. Universitäts-Frauenklinik in Berlin.) The cervix and external os are completely dilated and the myoma has been delivered into the vagina; in front, bladder and urethra.

Fig. 134.—Submucous Myoma (fibrous polyp) which has been expelled into the cervix and arrested at the external os. ½. (Original.) (From a specimen in the Kgl. Universitäts-Frauenklinik in Königsberg.)

Marked changes in the consistency of myomata are produced by pathologic processes in the substance of the tumors:

The hardness is increased by cicatricial (senile) shrinking of the intermuscular connective tissue (induration) or by calcification, which is most frequent in subserous, and rarest in interstitial tumors. Calcification usually begins at the centre, occasionally at the periphery, and forms layers like the skins of an onion; as a result of this process the myoma may become as hard as stone.

Softening, on the other hand, is a more important change because it not infrequently gives rise to diagnostic errors. It occurs almost regularly with the softening of the uterus during pregnancy, which also involves the myoma and renders it larger and softer; after parturition these changes slowly subside again. Necrobiotic processes in the myoma sometimes lead to fatty softening, which may go on almost to liquefaction of the tumor. It occurs during pregnancy, in the puerperium, and after other disturbances of nutrition. Total necrosis of the myoma, such as occurs in the Softening.

changes in interstitial myoma. The distention on the side of the myoma causes a marked increase in the length and width of the affected wall. The cavity is very much displaced eccentrically, being very close to one wall of the uterus and separated from the other by the entire thickness of the myoma. If the tumor projects into the cavity, the latter becomes somewhat curved (Fig. 147).

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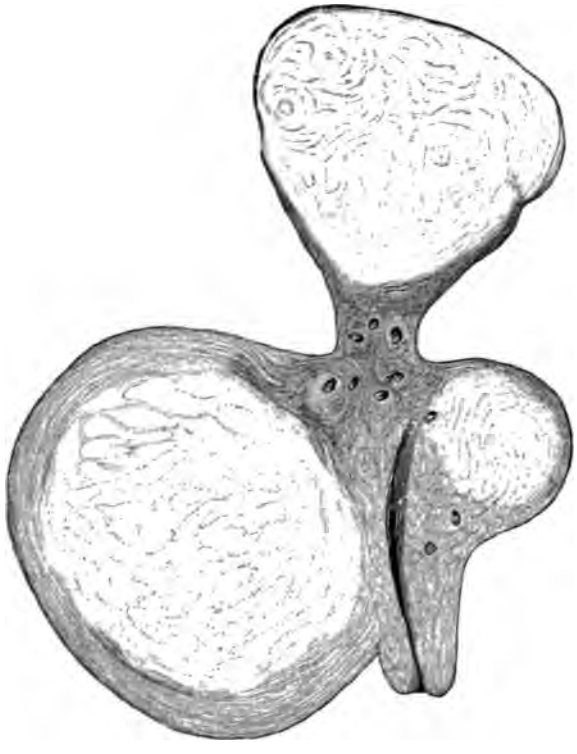

FIG. 130.—THE SAME IN SAGITTAL SECTION. ⅓. (Original.)

By pressure on the inner surface of the uterus and on the internal os submucous myomata excite reflex uterine contractions, which may produce considerable changes in the position of the tumor. The internal os dilates, and the top of the tumor enters and dilates the cervix: the tumor then reaches the external os, which it also dilates even to the extent of complete obliteration, and enters the vagina. Here the tumors are usually arrested or occasionally, under the influence of vigorous abdominal pressure, may be forced down in

Birth of a Myoma.

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organ (Fig. 138). If the tumor is very large it may occasionally be difficult to prove that one is dealing with the uterus. The positive signs are, the finding of the junction or transition of the vaginal portion with the tumor itself and noting that the cervix follows the movements of the tumor. When by means of these signs a large tumor has been definitely recognized as the uterus, it must be regarded as a myoma whenever the consistency is hard (Fig. 139). The exact situation of an interstitial myoma in the uterus cannot always be determined by palpation alone. If palpation through the anterior vault or from the two sides demonstrates that the cervix is broadened above the

FIG. 137.—SUBMUCOUS CERVICAL MYOMA (surface view and cross-section). (Specimen in the Kgl. Universitäts-Frauenklinik in Königsberg.) (Original.) The lip of the cervix in which the myoma is lodged is thickened in the form of a hemisphere and surrounded by the other lip in the form of a crescent.

vaginal vault and merges uniformly with the tumor, it is difficult to determine in which wall the myoma is lodged. But if the junction is found at the periphery instead of in the median line, and a portion of normal uterus can be felt at that point, it may be inferred that the cavity also lies there and that the myoma is accordingly on the other side. A simpler method of arriving at the desired result is the use of the sound (see p. 275).

The diagnosis of interstitial cervical myoma can usually be made without any trouble by the uniform nodular enlargement of one cervical wall and the crescentic distention of the opposite, attenuated wall. If the myoma occupies the lower portion of the cervix it produces a large tumor which projects into the vagina and, if the

external os is dilated, the bulging of the tumor into the lumen of the cervical canal can be distinctly recognized. The diagnosis is more difficult when a large tumor blocks access to the external os.

The diagnosis of submucous myoma is based on the same principles as that of an interstitial tumor so long as the cervix remains closed. Occasionally the uniformly round shape of the uterus and the junction of the cervix with the exact centre of the tumor may indicate that it is of the submucous variety. A positive diagnosis of submucous

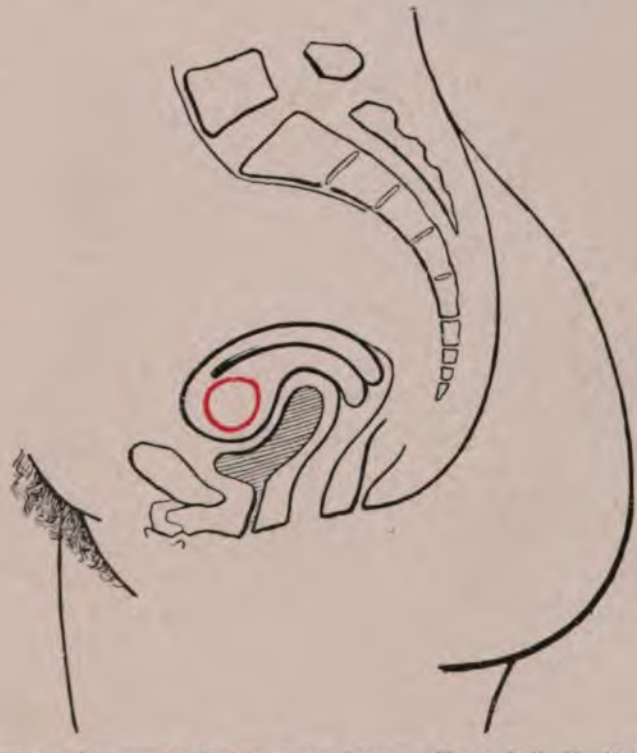

FIG. 138.—SMALL INTERSTITIAL MYOMA OF THE ANTERIOR WALL. P.-F. ⅓. (Original.) The uterine body is thick and hard, the lower uterine segment soft and thin; 9 cm. The anterior wall presents a spherical bulging. The sound shows a distinct difference in the thickness of the uterine walls.

myoma can be made only by direct palpation of the tumor when the cervical canal is open or the myoma is in process of being expelled (Fig. 140). Menstruation is a favorable time for making the diagnosis of a submucous myoma because the congestion which takes place in the tumor during this time frequently excites labor pains that dilate the cervix. After menstruation the myoma retires into the uterine cavity and the cervix closes up. Hence if in a case of severe menorrhagia there is reason to suspect a submucous myoma, an examination should, by all means, be made during menstruation. The finger introduced into the uterus feels either a hard

Submucous Myomata.

tumor in the uterine cavity, with a more or less extensive attachment to the uterine wall, or merely a spherical bulging of one of the walls.

CASE 19. I once made a curious mistake in examining the uterine cavity. I mistook a circumscribed bulging of the uterine wall for a myoma and operated. I very soon found out my mistake. Errors of this kind may certainly be avoided if attention is paid to the increase in thickness of the wall at the bulging point.

In order to determine the breadth of the connecting pedicle in submucous myoma when it cannot be directly felt, Fritsch suggests

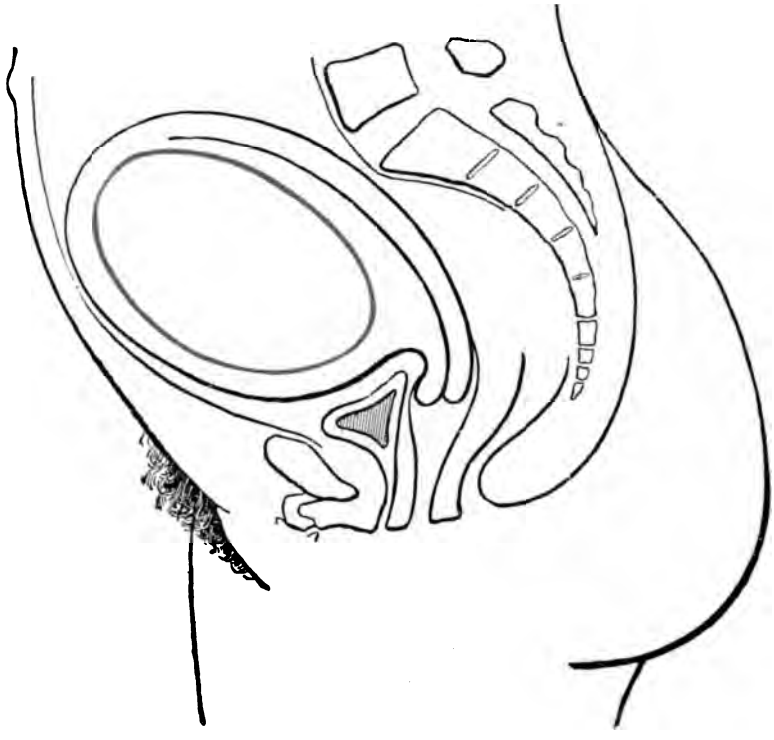

FIG. 139.—LARGE INTERSTITIAL MYOMA OF THE ANTERIOR WALL. P.-F. ⅓. (Original.) The uterus extends to within two fingers' breadth of the navel; the sound, 12 cm., rises at the posterior wall and the tip is distinctly felt through the tissues at the upper pole of the tumor.

that the myoma be grasped with Muzeux forceps and a rotary movement imparted to the uterus. The greater the rotation, the thinner must be the pedicle. As this method may, however, occasionally cause infection of the myoma, it should be employed only when immediate removal of the tumor is contemplated.

The diagnosis of small submucous myomata is always uncertain as long as the cervix remains closed, because the uterus, if the wall is not specially thick, is not necessarily enlarged or thickened. I have not infrequently found a submucous myoma the size of a walnut in a uterus of absolutely normal size and once even in an abnormally

small uterus; hence in cases of long continued and constantly recurring hemorrhage, particularly if associated with dysmenorrhea, one should think of a submucous myoma and satisfy one's self as to its presence or absence by exploring the uterine cavity with the finger. Submucous myoma may occasionally be suspected on account of the balloon-shaped enlargement of the cervix when the tumor has been expelled from the uterine body and arrested behind the external os like a cervical abortion; the vaginal portion in these cases becomes

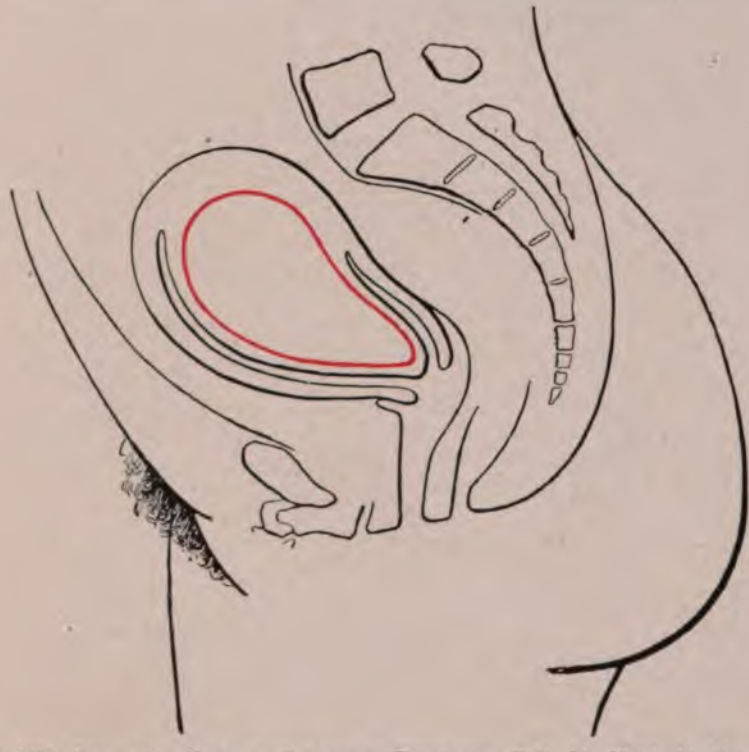

FIG. 140.—SUBMUCOUS MYOMA IN PROCESS OF EXPULSION. P.-F. ⅓. (Original.) The lower pole of the myoma is conical to adapt itself to the uterine cavity and cervical canal; the external os admits one finger; a small portion of the cervix is still undilated.

spherical and the myoma can be felt through the contracted os. The tumor can also be felt with the sound through the narrowed os; or, after incision of the os, with the finger.

Submucous cervical myomata are, as a rule, easily accessible to direct palpation, because they early cause dilatation of the external os and project into the vagina; the pedicle connecting the tumor with the cervical wall is readily palpated.

Subserous myomata are recognized by palpation more easily than any others. So long as they are small they appear as nodules or pedunculated tumors on the outer surface of the uterus and are usually

of hard consistency. In the case of large tumors, on the other hand, the physical signs depend on the nature of the connection with the uterus; if the attachment is very broad, the myoma and the uterus together form a single tumor and the unaffected remainder of uterus can be recognized only in one place by a protuberance, a margin or edge, or the softer consistency of the uterine muscle, or the junction of the cervix with the soft uterus (Fig. 142). The narrower the connection between the myoma and the uterus, the more difficult is the diagnosis of the uterine growth because the characteristics become more and more those of a tumor situated alongside of the uterus. If the pedicle is distinct, the uterus and the tumor can be felt separately and the diagnosis of myoma is based chiefly on the nature of the pedicle. The latter always possesses a certain consistency, is usually broad and short, and has a fleshy feel (Fig. 141). The diagnosis of subserous myomata is rendered difficult by the fact that they frequently lose their characteristic spherical shape; while, on the other hand, the diagnosis is simplified by the distinctly hard consistency of the tumors.

Subserous Myomata.

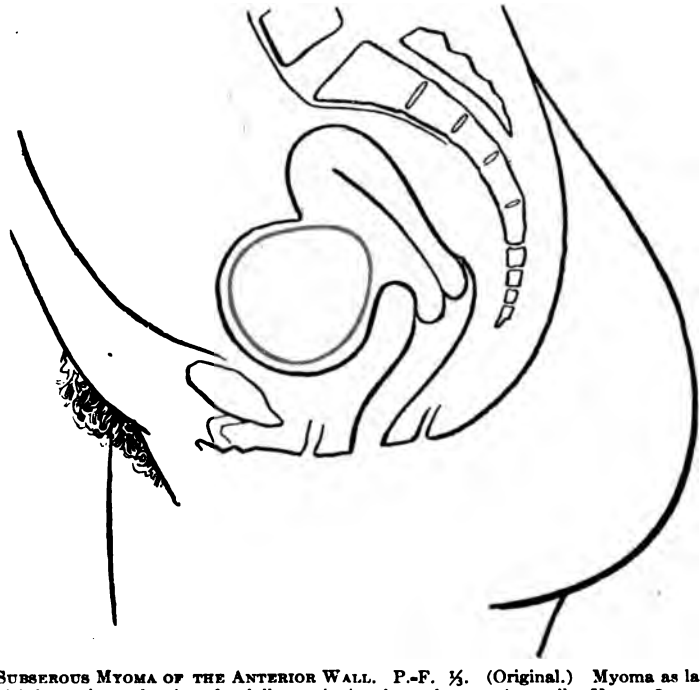

FIG. 141.—SUBSEROUS MYOMA OF THE ANTERIOR WALL. P.-F. ⅓. (Original.) Myoma as large as a fist, with base about the size of a dollar springing from the anterior wall. Uterus 8 cm.

The diagnosis of an intraligamentary myoma is based on the connection of the tumor with the lateral surface of the uterus. The attachment may occupy the entire lateral aspect (Fig. 143) or

may be very thin. Occasionally the myoma is completely separated from the uterine wall. Displacement of the uterus to one side, so that the organ projects deep down into the parametrial or paravaginal tissue, diminished mobility of the tumor, and the characteristic course of the adnexa (see p. 275) also point to intraligamentary myoma. The tumor may be assumed to be subperitoneal if it originates at a point on the uterus where there is no peritoneal attachment or the serous membrane is only loosely connected; such tumors are always deep-seated, corporeal or cervical myomata. In these cases a considerable portion of the uterine body, which is displaced upward or far to one side, can be differentiated from the myoma (Figs. 143 and 144). Intraligamentary myomata have a limited mobility, particularly from above downward, and cannot be displaced out of the true pelvis.

Intraligamentary and Subperitoneal Myomata.

FIG. 142. — THREE SUBSEROUS MYOMATA OF THE UTERUS. P.-F. ⅓. (Original.) On the right, a myoma the size of a fist; on the left, a smaller subserous myoma; in the surrounding mantle of uterine tissue below the tumor a very small nodule can be felt. The fundus of the uterus can be distinctly demonstrated with the sound, forming a saddle-shaped connecting piece between the two myomata. Sound 11 cm.

Palpation of the adnexa plays an important part in the diagnosis of myomata because without it the seat and variety of the tumor cannot be recognized with certainty. In every case an attempt should be made to determine the course of these structures, although unfortunately palpation is often impossible on account of the thickness of the abdominal walls. It is most important to trace the course of the round ligaments. The ligament is searched for immediately above the horizontal ramus of the pubic bone by forcibly depressing the abdomen with the external hand and passing the fingers to and fro in a direction perpendicular to the course of the ligament.

Palpation of the Adnexa.

If a firm cord is felt at this point, its course must be traced to the tumor for as great a distance as possible by using moderate pressure; the closer the connection between the ligament and the myoma, the more difficult it is to palpate it separately. If the round ligaments join the tumor and can be traced as far as the dome, it shows not only that the mass is a uterine tumor but, in addition, the position of the fundus can be determined by the course of the ligaments and the location of their junction with the tumor.

Round Ligaments.

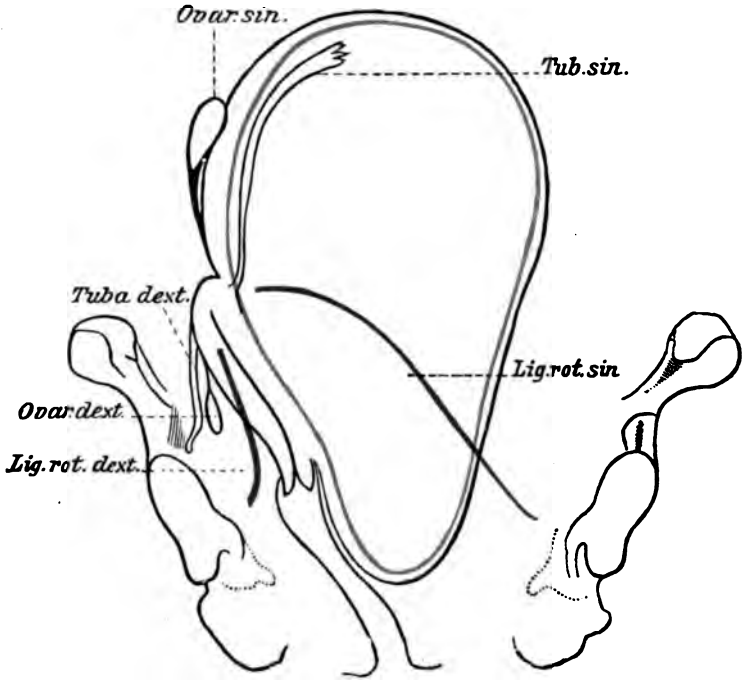

FIG. 143.—INTRALIGAMENTARY MYOMA OF THE ENTIRE LEFT UTERINE WALL. P.-F. ½. (Original.) The right adnexa are not altered. The left ovary occupies a position on the dome of the tumor, and the long-drawn-out left tube is above, on the anterior surface, while the left round ligament rotates downward from the anterior surface. Part of the myoma has developed below in the pelvic connective tissue.

The position of the ovaries is also affected by the presence of myomata because they are fixed to the lateral surface of the fundus by the short and unyielding ovarian ligaments; the latter can be felt only in exceptional cases when the walls of the abdomen are thin; they mark a path between the fundus and the ovary. The tubes usually cannot be felt except occasionally in intraligamentary myomata, when they may be demonstrated as thin cords that roll under the finger.

Ovaries.

The seat of the myoma and the direction of its growth can be accurately determined by the course of the round ligaments, approximately in the following manner:

If a subserous myoma is attached to the uterus exactly at the fundus it forms a large fundal tumor, and the round ligaments as well as the ovaries are not in relation with the tumor, but are situated underneath (Fig. 145_1).

If the myoma is situated in the uterus below the origin of the round ligaments, the latter are pushed upward and, if the tumor is symmetrically placed, the ovaries are found more or less displaced upward on each side of the tumor. This condition is seen with interstitial and submucous myomata (Fig. 142 and 145_2).

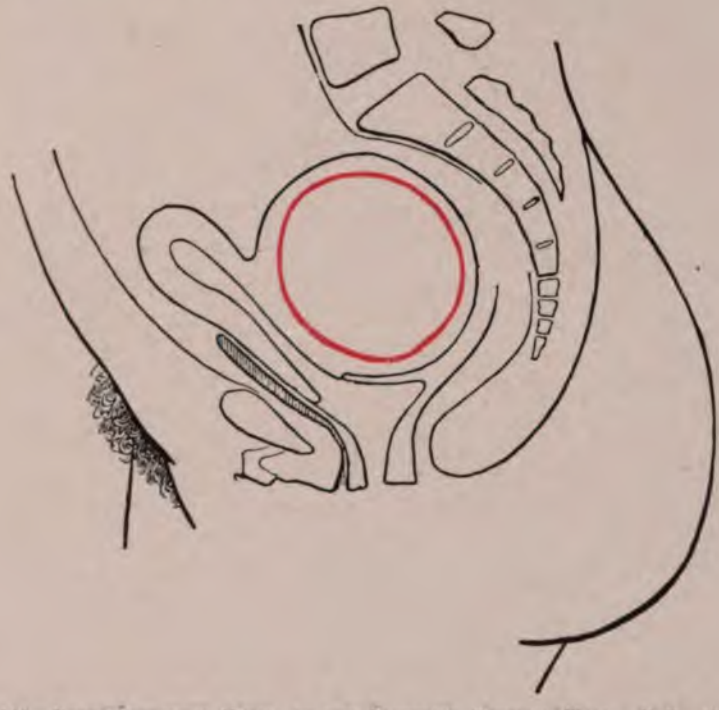

FIG. 144.—RETROPERITONEAL MYOMA OF THE POSTERIOR CERVICAL WALL. P.-F. ⅓. (Original.) Myoma of the posterior wall the size of the fist. Above is the partly movable uterine body. Sound 11.5 cm. The cervical canal admits one finger.

If the myoma occupies one wall of the uterus and causes distention —generally upward—of that wall, the uterus is oblique; on one side the round ligament is given off low down, on the other high up and passes obliquely over the tumor; one ovary is placed low down, the other high up on the tumor (Fig. 145_3).

With intraligamentary tumors the adnexa are found free by the side of the uterus on one side, while on the other side they are forced apart to such an extent that the round ligament occupies the anterior, and the ovary the posterior side, while the tube usually passes through the dome of the tumor (Fig. 145_4).

In myoma of the posterior wall the round ligaments join the anterior periphery of the tumor and the ovaries also are usually felt in front (Fig. 145_5).

In myoma of the anterior wall the course of the ligaments is entirely posterior and the ovaries are crowded far down into Douglas' space (Fig. 145_6).

In the case of cervical myomata the adnexa are not affected and retain their position alongside of the body, except that they are displaced upward along with the fundus by the myoma (Fig. 146).

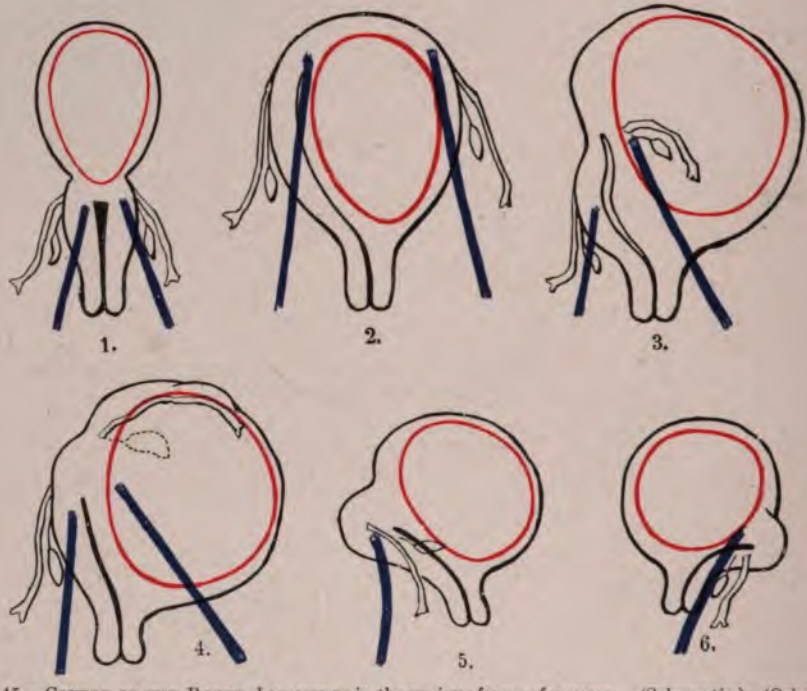

FIG. 145.—COURSE OF THE ROUND LIGAMENTS in the various forms of myoma. (Schematic.) (Original.) (For explanation see text.)

Sounding is an extremely important procedure in the diagnosis of myomata, but its application is unfortunately very limited because it is attended with dangers which are particularly apt to occur in the case of myomata. The greatest danger is infection of the uterine cavity with vaginal germs, and this must by all means be avoided in the case of myomata which are to be operated upon; hence the procedure should not be employed at all when an operation is in prospect. Perforation readily occurs in the presence of myoma because the uterine wall is very much attenuated; and, on account of the irregular course of the uterine cavity, injuries of the mucous membrane and of the myoma cannot always be avoided. The sound should,

Use of the Sound.

therefore, be used only when the desired information cannot be obtained by means of combined examination and palpation of the adnexa. In addition the use of the sound is attended by a number of difficulties. Often it is impossible to introduce the instrument, or it may catch in the projecting myoma or in the uterine wall and convey the impression that the fundus has already been reached; or the sound at the first trial may enter one cornu of the uterus and at the second trial the other, greatly distended cornu, and in that way very variable results are obtained. Hence the employment of the sound requires great care in the technic and in the interpretation of the findings, but with this precaution it is a very excellent diagnostic aid, and in many cases a positive diagnosis of myoma cannot be made without it.

FIG. 146.—COURSE OF THE ADNEXA IN A CERVICAL MYOMA. P.-F. ⅕. (Original.) Intraligamentary cervical myoma of the left wall. The appendages are easily palpated above, alongside of the body; only the lower portions of the round ligaments can be felt.

The objects of sounding are various. In the first place the uterine cavity can be found within the tumor; if the sound enters the tumor, or if the head of the instrument can be felt at some point on the periphery, or a large portion of the sound can be palpated through the wall, we know that the cavity lies within the tumor and that the latter is, therefore, in all probability, a uterine myoma. In the case of interstitial myomata it is possible to determine, by demonstrating the cavity with the sound, which wall of the uterus contains the myoma. If the myoma is subserous, the part of the uterus which has not become enlarged can be demonstrated by feeling the tip of the sound through the muscle. The most important information obtained with the sound is the length of the uterine cavity. The latter is always elongated even when

of hard consistency. In the case of large tumors, on the other hand, the physical signs depend on the nature of the connection with the uterus; if the attachment is very broad, the myoma and the uterus together form a single tumor and the unaffected remainder of uterus can be recognized only in one place by a protuberance, a margin or edge, or the softer consistency of the uterine muscle, or the junction of the cervix with the soft uterus (Fig. 142). The narrower the connection between the myoma and the uterus, the more difficult is the diagnosis of the uterine growth because the characteristics become more and more those of a tumor situated alongside of the uterus. If the pedicle is distinct, the uterus and the tumor can be felt separately and the diagnosis of myoma is based chiefly on the nature of the pedicle. The latter always possesses a certain consistency, is usually broad and short, and has a fleshy feel (Fig. 141). The diagnosis of subserous myomata is rendered difficult by the fact that they frequently lose their characteristic spherical shape; while, on the other hand, the diagnosis is simplified by the distinctly hard consistency of the tumors.

Subserous Myomata.

FIG. 141.—SUBSEROUS MYOMA OF THE ANTERIOR WALL. P.-F. ⅓. (Original.) Myoma as large as a fist, with base about the size of a dollar springing from the anterior wall. Uterus 8 cm.

The diagnosis of an intraligamentary myoma is based on the connection of the tumor with the lateral surface of the uterus. The attachment may occupy the entire lateral aspect (Fig. 143) or

may be very thin. Occasionally the myoma is completely separated from the uterine wall. Displacement of the uterus to one side, so that the organ projects deep down into the parametrial or paravaginal tissue, diminished mobility of the tumor, and the characteristic course of the adnexa (see p. 275) also point to intraligamentary myoma. The tumor may be assumed to be subperitoneal if it originates at a point on the uterus where there is no peritoneal attachment or the serous membrane is only loosely connected; such tumors are always deep-seated, corporeal or cervical myomata. In these cases a considerable portion of the uterine body, which is displaced upward or far to one side, can be dif-

Intraligamentary and Subperitoneal Myomata.

FIG. 142.—THREE SUBSEROUS MYOMATA OF THE UTERUS. P.-F. ⅓. (Original.) On the right, a myoma the size of a fist; on the left, a smaller subserous myoma; in the surrounding mantle of uterine tissue below the tumor a very small nodule can be felt. The fundus of the uterus can be distinctly demonstrated with the sound, forming a saddle-shaped connecting piece between the two myomata. Sound 11 cm.

ferentiated from the myoma (Figs. 143 and 144). Intraligamentary myomata have a limited mobility, particularly from above downward, and cannot be displaced out of the true pelvis.

Palpation of the adnexa plays an important part in the diagnosis of myomata because without it the seat and variety of the tumor cannot be recognized with certainty. In every case an attempt should be made to determine the course of these structures, although unfortunately palpation is often impossible on account of the thickness of the abdominal walls. It is most important to trace the course of the round ligaments. The ligament is searched for immediately above the horizontal ramus of the pubic bone by forcibly depressing the abdomen with the external hand and passing the fingers to and fro in a direction perpendicular to the course of the ligament.

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Round Ligaments.

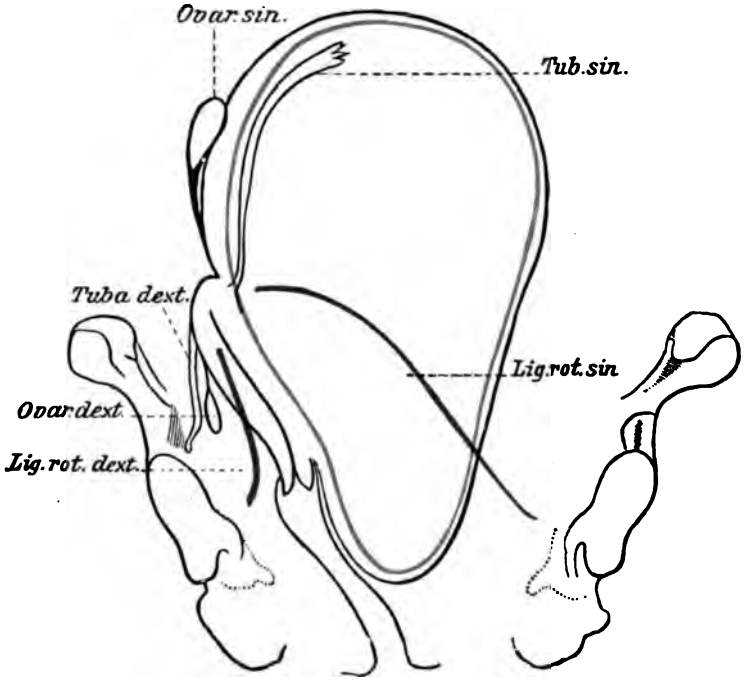

FIG. 143.—INTRALIGAMENTARY MYOMA OF THE ENTIRE LEFT UTERINE WALL. P.-F. ⅓. (Original.) The right adnexa are not altered. The left ovary occupies a position on the dome of the tumor, and the long-drawn-out left tube is above, on the anterior surface, while the left round ligament rotates downward from the anterior surface. Part of the myoma has developed below in the pelvic connective tissue.

The position of the ovaries is also affected by the presence of myomata because they are fixed to the lateral surface of the fundus by the short and unyielding ovarian ligaments; the latter can be felt only in exceptional cases when the walls of the abdomen are thin; they mark a path between the fundus and the ovary. The tubes usually cannot be felt except occasionally in intraligamentary myomata, when they may be demonstrated as thin cords that roll under the finger.

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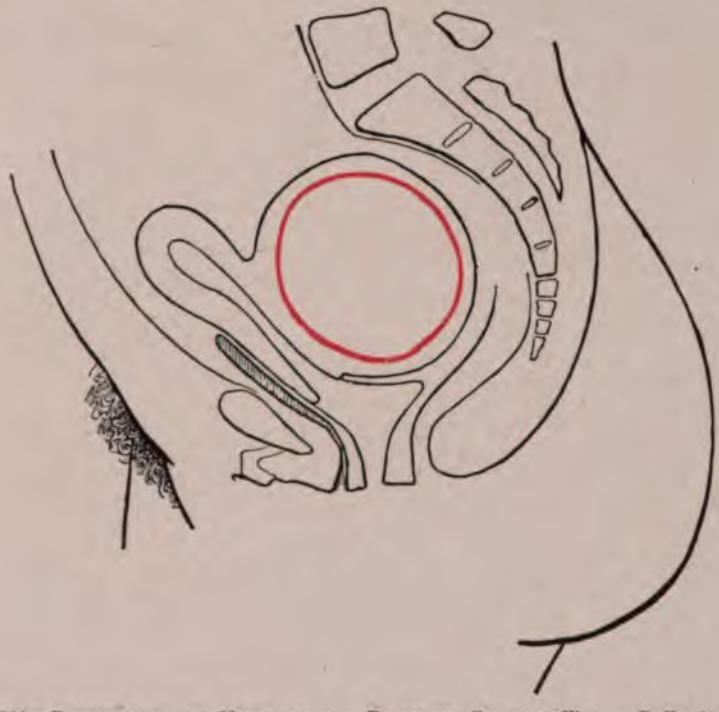

FIG. 144.—RETROPERITONEAL MYOMA OF THE POSTERIOR CERVICAL WALL. P.-F. ⅓. (Original.) Myoma of the posterior wall the size of the fist. Above is the partly movable uterine body. Sound 11.5 cm. The cervical canal admits one finger.

If the myoma occupies one wall of the uterus and causes distention —generally upward—of that wall, the uterus is oblique; on one side the round ligament is given off low down, on the other high up and passes obliquely over the tumor; one ovary is placed low down, the other high up on the tumor (Fig. 145_3).

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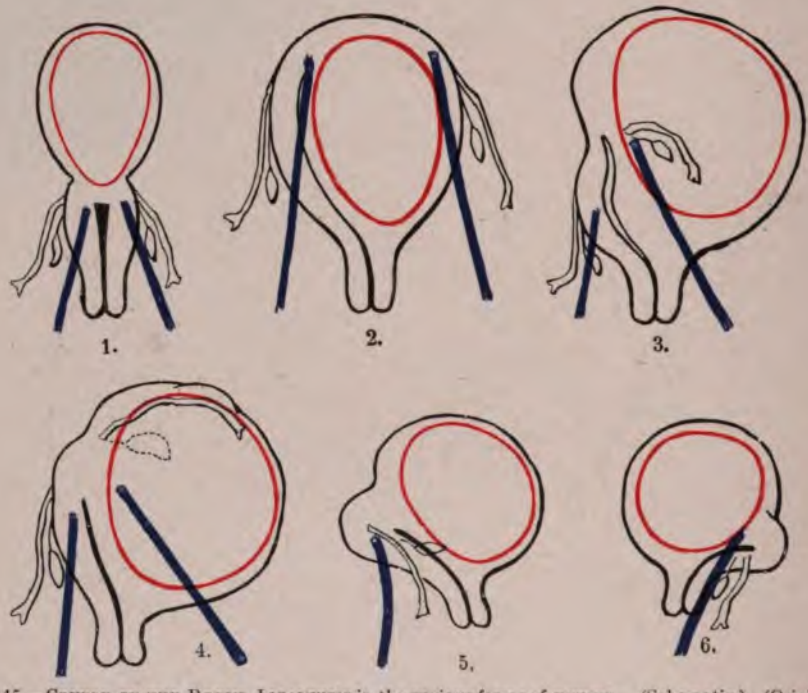

FIG. 145.—COURSE OF THE ROUND LIGAMENTS in the various forms of myoma. (Schematic.) (Original.) (For explanation see text.)

Sounding is an extremely important procedure in the diagnosis of myomata, but its application is unfortunately very limited because it is attended with dangers which are particularly apt to occur in the case of myomata. The greatest danger is infection of the uterine cavity with vaginal germs, and this must by all means be avoided in the case of myomata which are to be operated upon; hence the procedure should not be employed at all when an operation is in prospect. Perforation readily occurs in the presence of myoma because the uterine wall is very much attenuated; and, on account of the irregular course of the uterine cavity, injuries of the mucous membrane and of the myoma cannot always be avoided. The sound should,

Use of the Sound.

therefore, be used only when the desired information cannot be obtained by means of combined examination and palpation of the adnexa. In addition the use of the sound is attended by a number of difficulties. Often it is impossible to introduce the instrument, or it may catch in the projecting myoma or in the uterine wall and convey the impression that the fundus has already been reached; or the sound at the first trial may enter one cornu of the uterus and at the second trial the other, greatly distended cornu, and in that way very variable results are obtained. Hence the employment of the sound requires great care in the technic and in the interpretation of the findings, but with this precaution it is a very excellent diagnostic aid, and in many cases a positive diagnosis of myoma cannot be made without it.

FIG. 146.—COURSE OF THE ADNEXA IN A CERVICAL MYOMA. P.-F. ⅛. (Original.) Intraligamentary cervical myoma of the left wall. The appendages are easily palpated above, alongside of the body; only the lower portions of the round ligaments can be felt.

The objects of sounding are various. In the first place the uterine cavity can be found within the tumor; if the sound enters the tumor, or if the head of the instrument can be felt at some point on the periphery, or a large portion of the sound can be palpated through the wall, we know that the cavity lies within the tumor and that the latter is, therefore, in all probability, a uterine myoma. In the case of interstitial myomata it is possible to determine, by demonstrating the cavity with the sound, which wall of the uterus contains the myoma. If the myoma is subserous, the part of the uterus which has not become enlarged can be demonstrated by feeling the tip of the sound through the muscle. The most important information obtained with the sound is the length of the uterine cavity. The latter is always elongated even when

only part of the myoma occupies the uterine wall; the only exception to this is found in the case of subserous myomata connected with the uterus by a thin pedicle, in which the cavity may be of normal length. The shape of the uterine cavity can also be determined by means of the sound, inasmuch as a limited excursion of the instrument indicates a normal cavity, while in the presence of marked dilation, as, *e.g.*, with interstitial myoma, the sound can easily be moved about in various directions. The greatest excursions are experienced in the case of submucous myomata and it often seems as though the instrument were gliding over a prominence (Fig. 147). The diagnosis of submucous myoma with the sound is by no means so positive as might be supposed. While small, hard myomata are not likely to be missed, the sound may pass completely around a large tumor without its presence being recognized. In several

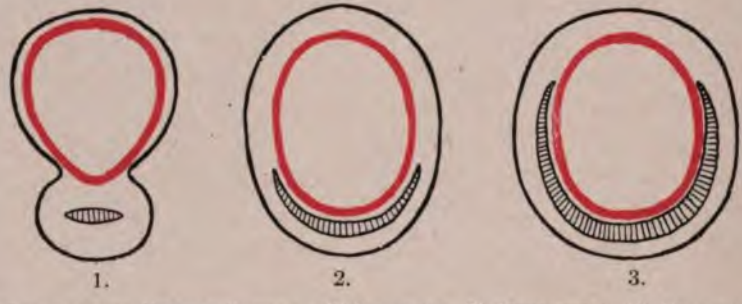

FIG. 147.—SHAPE OF THE UTERINE CAVITY IN (1) SUBSEROUS, (2) INTERSTITIAL, (3) SUBMUCOUS MYOMA. (Schematic.) (Original.)

instances I have failed to recognize large submucous tumors although I paid every attention to this point in my examination. Under such conditions the only way to make a positive diagnosis is by digital exploration.

In the presence of a conglomeration of various tumors orientation may be exceedingly difficult. The examiner should first attempt to find the fundus, which is usually at the point where the bases of the various myomata come together. In order to find the uterus we then determine by palpation which part of the tumor is most directly joined to the cervix, or we find a point of the tumor from which pressure is most distinctly transmitted to the cervix. If this method fails, we try to recognize the fundus with the sound or to determine its position by the course of the round ligaments, taking advantage also of the difference in consistency between the soft uterine muscle and the hard myoma. After the uterine body has been positively demonstrated, the connections between it and the individual myomata are determined by the above mentioned palpatory findings and results obtained by sounding.

In comparison with that of the objective signs, the diagnostic value of the symptoms and history is insignificant. There is no symptom that applies only to myoma, although hemorrhage, dysmenorrhea and sterility are observed much more frequently than in the case of other abdominal tumors. The important question whether a large tumor originates in the uterus or in the ovary cannot be decided by the presence of the above symptoms, which are in the main uterine, as the same symptoms may be produced by ovarian tumors or the latter may happen to be present at the same time.

Differential Diagnosis.

In accordance with the different results obtained by palpation in cases of subserous, interstitial and submucous myomata, a number of pathologic conditions must be considered in the differential diagnosis.

Subserous Myomata.

Subserous myomata are tumors which develop outside, or alongside of the uterus and are therefore most apt to be confounded with tumors of the adnexa or the parametrium.

From a practical standpoint the differential diagnosis between myoma and an ovarian tumor is the most important.

Retro-uterine hematocele and intraligamentary hematoma may resemble myomata if the consistency is more or less firm owing to coagulation of the blood and inflammatory reaction in their neighborhood; although even under these circumstances the consistency rarely becomes so uniformly hard as that of a myoma. Another point of difference is the broad connection between hematomata and the adjacent structures, particularly the pelvic wall, which is entirely absent in myoma unless it is complicated with an exudate. By reason of this broad connection, which is produced by the coagulation of the blood and the subsequent formation of adhesions with the uterine wall, the hematoma is always in intimate contact with the uterus, whereas subserous myomata are attached to the uterus by a more or less broad base or a pedicle. The differential diagnosis between intraligamentary hematoma and myoma is much more difficult because the characteristic features of both tumors are obscured by the investing peritoneum and the reaction in the connective tissue. As large hematomata are almost always the result of disturbed tubal pregnancy, the diagnosis will usually be suggested by the characteristic history of that condition. In doubtful cases distinct shrinking is observed in the course of a few weeks' observation, while a myoma remains stationary.

For the difference between subserous myomata and exudates, see the latter.

For the difference between subserous myomata and pyosalpinx, see the latter.

Not infrequently a subserous myoma is mistaken for the uterine body, particularly if it is exactly the same size and joins the cervix in the same manner. It is often difficult to decide by the shape and size alone which of the two masses is the uterus and which the myoma; occasionally the question may be decided by the consistency, which is harder in the myoma; if not, it can always be done by introducing the sound. One horn of a bicornute uterus is often mistaken for a subserous myoma, an error which can best be avoided by introducing the sound into both cornua, or by the adnexa which in the case of uterus bicornis must originate in the outer surface of the tumor, while in the case of subserous myoma they must both originate from the other tumor, the uterus.

The physical signs of tumors of the round ligaments frequently cannot be distinguished from those of subserous myoma if they are limited entirely to the abdomen. As they are usually fibromyomatous tumors, the consistency is also hard, and practically no differences are observed as regards the connecting pedicle, shape and mobility. As soon as part of the tumor has broken through the inguinal canal, a solid portion makes its appearance in front of the external ring which may resemble herniæ of various kinds; but the connection between this extra-abdominal portion and an intra-abdominal tumor of the above described character situated in a corresponding region makes the diagnosis of fibromyoma extremely probable.

Interstitial myomata are likely to be mistaken only for conditions which lead to more or less uniform enlargement of the uterus. The distinction which the physician is most frequently called upon to make is between an interstitial myoma and pregnancy. While it is an obvious mistake on account of the similar shape of the uterus, and while it has often been made by less experienced examiners in actual practice, a positive decision is nevertheless possible in almost every case. During the early months of pregnancy the differential diagnosis is difficult because at this time softening may still be very slight; but if the latter symptom is present anywhere, either in the vaginal portion or in the body, pregnancy is the more probable condition. When a myoma is present the uterus is often harder and more tense than a non-gravid uterus, and occasionally a distinct difference in consistency can be recognized between the myoma and the uterine muscle. If, *e.g.*, the myoma occupies the upper portion of the uterine body, Hegar's sign may often be simulated by the softening below the tumor. The most difficult decision is that between myoma and early pregnancy with a dead fetus, because the softening may subside altogether; but in this condition a remnant of compressibility of the lower uterine segment is partic-

Interstitial Myomata.

ularly valuable; not infrequently a slight bluish discoloration and softness of the vagina persist. The larger the myoma, the easier will be the differential diagnosis because the softening ought to be greater at the corresponding period of pregnancy. A soft consistency of the tumor is the characteristic feature of pregnancy. Not infrequently, however, myomata become so soft from the accumulation of fluid or degenerative conditions as greatly to resemble the gravid uterus in consistency; but the softening of the vaginal portion and of the vagina, which is practically never absent in pregnancy at this period, is rarely found. An almost absolutely positive sign of pregnancy is a change in the consistency. Uterine contractions occur very rarely with myomata and must be interpreted as the labor pains of pregnancy.

I have seen one case which showed that even this sign is not reliable.

CASE 20. Mrs. E., age 53. Tumor the size of a man's head in the median line, easily recognized as the enlarged uterus by its junction with the vaginal portion. Consistency distinctly cystic. Several times in the course of my observation I found the tumor hard and firm, but the change in consistency always occurred so gradually that I could never demonstrate a direct transition from a cystic to a solid consistency or *vice versa*. There was no doubt, however, that the uterus was contracting. The tumor when removed was found to contain a large unilocular cyst, surrounded by uterine wall the thickness of the finger, which had contracted from time to time on the cyst.

If the myoma extends above the umbilicus, pregnancy can be excluded with a tolerable degree of certainty because at this time fetal signs should be present. Difficulties may arise in the case of extrauterine pregnancy or pregnancy with a dead fetus. Diagnostic difficulties always arise from the tendency of the gravid uterus to contract isolated portions of its walls, which, by causing constriction and an increase in hardness, simulate myomata. The temporary character of these phenomena and the distinct softening observed in other places establish the diagnosis of pregnancy.

The history is of some value in the differential diagnosis inasmuch as complete amenorrhea corresponding in duration to the size of the tumor is in favor of pregnancy, whereas regular menstruation is more indicative of myoma. It must be emphasized, however, that mistakes are frequently made on account of the occurrence of irregular hemorrhages which are mistaken for menses and on account of amenorrhea due to other causes; hence the importance of the history is much less than that of the objective signs in the hands of an experienced observer. Keeping the patient under observation is of much more value; if the fetus is living, all doubts can be removed within a month.

The difficulty of the differential diagnosis between pregnancy and myoma is illustrated in the following case:

Case 21. A woman of 55 is sent to the hospital for a myomotomy. A tumor of the size and shape of the uterus in the first months of pregnancy is found with its upper boundary at about the level of the navel. The consistency of the tumor is doughy and soft. The round ligaments pass through the dome of the tumor. Fetal signs, fetal parts and heart sound or fetal movements cannot be demonstrated. The vulva is not discolored; the vagina is somewhat bluish red; the posterior lip is the color of wine yeast and somewhat soft. The patient says that her menstruation has been regular until three months ago and that she has suffered from nausea for the past three weeks; but she does not consider herself pregnant. Pregnancy was considered on account of the softness of the tumor and of the vaginal portion and on account of the history; it could not be positively proven, however, on account of the absence of fetal signs and was furthermore improbable on account of the patient's advanced age. Diagnosis was therefore reserved. At an examination made a few days later a doubtful change of consistency was demonstrated, establishing the diagnosis of pregnancy. At the abortion which occurred a few days later a large blood mole was evacuated.

Interstitial myomata not exceeding the size of a fist are sometimes very difficult to distinguish from chronic metritis. The history contributes little of value to the diagnosis, as small myomata are frequently accompanied by inflammatory symptoms both at the beginning and during their subsequent growth; on the other hand a positive result may be obtained in favorable cases by combined examination. The enlargement of the metritic uterus is usually uniform in all directions, while in the presence of myoma the wall is often enlarged asymmetrically; the muscle in metritis is somewhat soft and painful during the recent stage, becoming hard and unyielding only when the disease is chronic, while in myoma the uterine wall is hard and tense and the tumor can often be differentiated from the healthy muscle by its consistency; besides, a myoma is rarely painful. The state of the cervix must also be considered in making the diagnosis. Chronic metritis usually involves the cervix, and both uterine body and cervix are uniformly thick and hard and the cervico-corporeal angulation is rigid, whereas in myoma the cervix remains soft and slender. A decision can usually be made quite easily with the sound. Whereas in chronic metritis the instrument enters the middle of the uterus and can be felt equally well through the wall at any point, it will deviate to one side in the presence of myoma and a distinct difference will be noted, depending on whether the sound is felt through a myomatous or through a normal uterus. If the uterus becomes distinctly enlarged in the course of time, the diagnosis of myoma is positive.

Submucous myomata. When the cervix is completely closed, the physical signs are similar to those of interstitial tumors; like the latter, submucous myomata are occasionally mistaken for pregnancy or chronic metritis. On the other hand, if the cervical canal is open and the finger can be inserted into the uterine cavity, the conditions found are quite characteristic (see p. 267). Nevertheless the tumors are

Submucous Myomata.

not infrequently mistaken for other, similarly formed intra-uterine growths, particularly abortion in the second month. So-called cervical abortion, in which the mass is arrested behind the closed external os, and the cervix is enormously dilated and tightly stretched, contrasting with the empty, but somewhat enlarged uterine body above, produces a picture quite similar to that of a submucous myoma in a nullipara after it has reached the external os in the process of expulsion. An intact ovum also, although still entirely *in situ*, may produce the same conditions within the uterus that are found in submucous myoma. The distinction is made by the physical signs of pregnancy and by the data obtained from the history, especially the softening of the vaginal portion and vagina. If the polypoid body can be seen or felt in its entirety, the diagnosis is more certain. Fetal parts usually appear black from the presence of infiltrating blood, while myomata that are still situated in the cervix do not become gangrenous and the mucous membrane is usually of the normal red color. On palpation the fetal part is recognized by its friable consistency and the ease with which it can be separated from the uterine wall, while myomata have a smooth surface and firm consistency and are organically united to the uterus. The greatest difficulties arise in the distinction between a retained ovum that has died early in the course of pregnancy and a submucous myoma; under these circumstances also the fact that the tumor can be easily crushed and separated from the uterine wall suggests that it is a product of gestation. The history in a case of pathologic pregnancy may be misleading on account of continued hemorrhages.

The distinction between fibrous polyps and mucous polyps is of practical importance. In pronounced cases it is not difficult to differentiate between the two: in comparison to the round shape, smooth surface and firm consistency of submucous myomata, mucous polyps are usually oval and often lobulated or divided into several sections; the surface in most cases is irregular from the presence of retractions and lacunæ, rarely smooth; quite often follicles that have ruptured project above the surface and in some places mucus is seen escaping from the follicles. The mucous membrane is bright red and bleeds easily, unless changes (metaplasia) have taken place in the epithelium of those portions which project into the vagina, in which case it is pale-red or violet, like vaginal epithelium. The pedicle of mucous polyps is usually much thinner and their consistency in the main much softer; although myomata in process of expulsion may also become soft and edematous. In a great many cases the physical signs are so obscure that a clinical diagnosis is not possible; even with the microscope the classification of polyps is by no means always easy because so many transitional forms occur.

If the submucous myoma is in the vagina and is of suitable size it may be mistaken for the inverted uterine body. From a practical standpoint it is exceedingly important to differentiate sharply between these two conditions. The error in almost every case consists in mistaking an inversion of the uterus for a myoma—not *vice versa*—and operating for the purpose of removing the tumor, a mistake which may be followed by the most regrettable consequences to the patient. In order to escape such a serious error it is important to exclude all possibility of inversion in every case of submucous myoma large enough to be mistaken for that condition, before deciding to extirpate the tumor. The distinction between the two conditions is based on the relation of the tumor to the cervix and the uterine body. In cases of inversion, if the cervix is still partially preserved, the junction of the neck of the tumor with the inner wall of the cervix is easily felt by the palpating finger introduced high up in the cavity; whereas the polyp is connected to the wall only at one point and on the other side the finger can be carried past the pedicle and introduced into the upper portion of the cervix. If the finger cannot be introduced far enough, the sound is employed, with the aid of which the junction of the inverted uterine body with the inner surface of the remaining cervical portion can also be felt everywhere; whereas in the case of polyps the instrument glides past the tumor on one side and penetrates far into the uterine cavity. The differential diagnosis can however be made much more certainly by bimanual examination, in most cases through the rectum and abdominal walls. In the case of submucous myomata the uterus—of normal size unless enlarged by other myomata—is felt above the tumor, whereas in inversion the palpating fingers come together immediately above the cervix and the inversion-funnel can be recognized from above, particularly in anesthesia. Partial inversion is more difficult to recognize because the uterus is felt above the cervix; careful examination, however, shows that the uterus is too small and presents a distinct depression at the lateral aspect or, more frequently, at the fundus. The signs presented by the tumor in the vagina are all more or less ambiguous. The size in both cases may happen to be the same. The consistency of the inverted uterine body is usually somewhat softer and more yielding, but a myoma may also lose its hard consistency as the result of secondary changes; the mucous membrane appears red on both, unless gangrene develops, although the surface of the inverted uterus is often somewhat rough; the menstrual escape of blood from the mucous membrane, which might suggest the possibility of inversion of the uterus, is generally obscured by irregular hemorrhages. The only sign obtained by inspection with the speculum which might lead to the diagnosis is the demonstration of both tubal orifices, especially if they can be sounded.

Large round tumors of the vaginal wall, with smooth surface, such as sarcoma and in rare cases of carcinoma, as well as large round tumors of the vaginal portion, are differentiated from submucous myomata most easily by their relation to the cervical canal. If the finger can be introduced high enough—in anesthesia if necessary—to feel the pedicle disappearing into the cervical canal, the diagnosis of myoma is assured; if it cannot be reached with the finger, the fact that the tumor becomes narrower as it approaches the vaginal portion and the absence of any connection with the vaginal wall may suffice for the diagnosis. Occasionally secondary adhesions, which must not be mistaken for pedicles, may be felt between a myoma and the vaginal wall. They usually yield readily to the pressure of the finger.

Diagnosis of Certain Complications.

In the course of the development of a myoma, which may be quite protracted, complications not infrequently arise either in the tumor itself or in the adjacent organs as a result of its presence. The clinical picture as a whole may be considerably modified by these complications, and it becomes a physician's duty to recognize them in time to apply the proper treatment; while, on the other hand, their recognition is important because the principles on which the diagnosis of simple myomata is based cannot always be applied to the complications also.

The complication of pregnancy and myoma is particularly important and its diagnosis is difficult. The importance lies in the fact that degenerations of various kinds develop in myomata under the influence of pregnancy and, on the other hand, the presence of a myoma may seriously interfere with the course of gestation, parturition and the puerperium. The diagnosis is difficult because, in a gravid uterus the seat of myomata, the signs and symptoms of the two conditions are both present and mutually modify one another. The principal changes in the gravid uterus, increase in size and softening, cannot be easily demonstrated in the myomatous uterus because it is itself enlarged and the consistency is hard. Hence softening is never found in the entire organ, being present only in that portion of the uterine wall which is free from myomata. If, *e.g.*, the cavity is completely surrounded by interstitial and subserous myomata, softening is absent altogether; again, the sign is not available if that portion of the body which becomes distinctly softer occupies a region not accessible to palpation, *e.g.*, the posterior part of the organ. Another factor which renders this valuable diagnostic sign of simple pregnancy uncertain in the presence of myomata is that these tumors from the beginning vary greatly in their consistency and may become as soft as the gravid uterus from the presence of zones of cystic degeneration. Softening of a definite portion of the tumor is of

positive value only if it can be shown that the softening is increasing and that the corresponding segment of the tumor was previously solid, especially if the latter can be identified as the uterine body by the course of the round ligaments. Before the third or fourth month I have practically never been able to make a diagnosis of pregnancy based on softening of one portion of a tumor.

The same uncertainty attaches to the second sign—enlargement of the uterus. Whatever enlargement is observed is at first referred to the myoma, and it is only when the enlargement is exceptionally rapid or confined to a definite portion that the phenomenon is of value. In some of my cases the occurrence of pregnancy was indicated by the statement on the part of the patient that the myoma had grown rapidly during the last months. In such cases the myoma itself does not enlarge; it is merely elevated more rapidly on account of the increase in size of the gravid uterus below. It is evident that the diagnostic difficulties are much less in the case of pregnancy with a subserous myoma or an interstitial growth involving only one wall; in fact whenever the entire uterus or at least the greater part of it can be palpated in the non-gravid state, the changes produced in the organ by pregnancy can also be recognized.

Owing to the uncertainty of the signs of pregnancy in the body of the uterus, the value of the signs in the vaginal portion and in the vagina, which are easily recognized, is much greater. Marked softening of these parts, particularly if progressive, and a distinct bluish discoloration are valuable factors in the diagnosis. The last doubts are often dissipated by the history of amenorrhea. The cessation of menstruation in a sexually mature woman should always excite the suspicion that conception has taken place in the myomatous uterus, and if the physician's suspicions have thus been aroused he will not fail to interpret the first changes in the uterine body correctly. To be sure, pregnancy may exist without amenorrhea. For, on the one hand, regular menstruation may occur several times in the case of myoma owing to the hyperplastic condition of the endometrium; and, on the other hand, irregular hemorrhages which presage a later absorption often occur early. Occasionally the occurrence of pregnancy may be revealed by the appearance of new symptoms; the patient often complains of increased pain and bladder symptoms at the very beginning of pregnancy.

In spite of the many changes that occur at the beginning of pregnancy, it frequently happens that the condition is overlooked in the early months. During the later months the diagnosis is always easier because the gravid portion of the uterus is always larger than the myoma, and the fetal signs become more and more distinct. The mistakes which are made during the later months consist in failure to discover

the myoma or in mistaking it for fetal parts. When small myomata in the gravid uterus are in a favorable situation for palpation they are recognized by their hardness, which, to be sure, is somewhat modified by the general softening of pregnancy, and by their situation in the uterine wall. It must be remembered that the pedicles of myomata, which may at first be quite distinct, may broaden out as a result of the constant distention, greatly increasing the area of attachment. If the myomata are situated in the posterior wall, in the fundus under the dome of the diaphragm, or in the region of the kidneys under the intestines, they may entirely escape palpation. The error of mistaking them for fetal parts may be avoided by remembering that the latter are underneath the uterine wall, that they can be moved about under the wall, and disappear when the uterus contracts; whereas myomata are exterior, are rendered more distinct by the uterine contractions, and can be displaced only on or with the uterus. The mistake is particularly apt to be made if the myomata resemble, in shape and size, the two large fetal parts.

Complications with inflammatory diseases in the neighborhood are very frequent in the case of myomata. The inflammation may be caused by the myoma or may have no connection with it. The importance of this complication is twofold: in the first place, a recent inflammation contraindicates operation and, after it has become chronic, renders it more difficult; in the second place, symptoms which are exclusively caused by the inflammation, such as pain, may be erroneously referred to the myoma and a false significance may be attached to the tumor.

The frequency with which inflammatory complication is the cause of so-called myomatous pain is shown by the fact that out of 57 cases of myomata, in which I made an accurate microscopic and clinical examination to determine the cause of the pain, it was found 19 times in some inflammatory condition of a neighboring organ.

Hence in all those cases at least in which pain is present, the physician must examine for inflammatory processes. They are exceedingly frequent in the parametrium, in the form of bands or thickenings binding the cervix to the pelvic wall, and usually have no connection with the myoma. When they are pressed upon or stretched by displacing the cervix, pain is complained of. As these adhesions are readily accessible to palpation, the diagnosis is not difficult provided examination of the parametrium is thought of at all. Perimetritis is more difficult to demonstrate. Adhesions, even when they unite different myomatous nodules, are never palpable, and pain on pressure, complained of during palpation of the serous surface, is much more likely to be due to changes in the myoma than to perimetritis. The only sign that indicates a probable previous perimetritis is fixation of the entire

myomatous uterus or of individual nodules in the region of the serous investment. The most frequent complications under this head are inflammatory processes of the tubes, ranging from simple salpingitis to large retention tumors filled with pus or serous fluid. Even these alterations are usually difficult to recognize because smaller tumors hide among the myomatous nodules or, if their consistency is hard, are themselves mistaken for nodules. Cystic tumors are usually mistaken for ovarian tumors. If, on the other hand, tumors with indistinct outlines and great sensitiveness on pressure are found in the situations where the adnexa are supposed to be, or if localized adhesions of the parietal peritoneum can be demonstrated at these points, tubal disease is probable, particularly if the process is bilateral. Certain statements on the part of the patient, such as the previous occurrence of one or more attacks of abdominal pain, inflammation, or hemorrhage occurring chiefly during hard physical labor, lifting, walking, etc., indicate that the symptoms are due to the inflammation rather than to some cause within the myoma. (For further details see the diagnosis of perimetritis, pelveo-peritonitis and tubal diseases.)

Twisting of the pedicle is much more rare in myomata than in ovarian tumors on account of the shortness and thickness of the pedicle. Nevertheless it occurs just often enough in the case of subserous myomata with thin pedicles to demand notice on account of the gravity of the clinical picture that is produced. The latter is similar to that seen in torsion of ovarian tumors. Sudden pain in the abdomen, repeated once or twice, occurs either after a slight injury or spontaneously, becomes localized in the myoma, and usually subsides again in the course of hours or days. Contrary to ovarian tumors the accident is rarely followed by peritonitis with adhesions, because owing to the greater thickness of the pedicle the circulation is not abolished and normal conditions are soon restored. Nevertheless the changes which are observed in the tumor show that the circulation is considerably impaired.

The diagnosis is based on the above statements of the patient and on the great sensitiveness on pressure in cases of tumors with thin pedicles.

CASE 22. Miss R., in 1902, had a sudden prolonged attack of cramp in the right inguinal region lasting three days; in 1904 two more similar attacks, and in February, 1905, a final attack of the same kind; during the intervals complete freedom from pain. Examination revealed a subserous myoma as large as the fist at the right aspect of the uterus, the pedicle of which at the operation was found to have become twisted one and one-half times around its own axis.

Twisting of a uterus uniformly enlarged by an interstitial myoma is exceedingly rare and produces the same symptoms.

The **urinary complications** demand careful consideration. Before the proper treatment can be instituted it must be definitely decided

whether the urinary symptoms are due to a complicating condition of the bladder, or directly or indirectly to the myoma itself. Ischuria may be regarded as a mechanical disturbance of urination due to the myoma, whereas tenesmus, which is much more frequent, and dysuria may be due to a complicating cystitis or to the myoma alone. These symptoms are much too frequently attributed to the myoma, which is supposed by its position on the bladder to compress the viscus and interfere with its function. The first step in determining this point is to examine the urine (obtained by catheter) for signs of cystitis; if the findings are positive, the cystitis may be assumed as the cause of the symptoms and subjected to treatment at once. But even the absence of bladder constituents in the urine is not sufficient to prove that the

FIG. 148.—CYSTOSCOPIC PICTURE WHEN THE FLOOR OF THE BLADDER IS GREATLY ELEVATED BY A SUBMUCOUS MYOMA IN THE VAGINA. The floor of the bladder, which forms a hemispherical bulging in the cavity, is illuminated only in its posterior portion. The urethral orifice is not illuminated.

FIG. 149.—CYSTOSCOPIC PICTURE OF A CLEFT BLADDER IN A CASE OF INTERSTITIAL MYOMA. Below, the anterior bladder wall with the crest of the symphysis; above, the bulging posterior wall which is pushed in by the myoma; between the two, the greatly contracted lumen of the bladder.

myoma is the cause of the symptoms; for there are many other causes of strangury in the female which must be excluded. Such changes may be inferred from certain relations between the myoma and the floor of the bladder which can be determined by palpation; but positive information can be obtained only with the cystoscope. The changes seen in the cystoscopic image are of two kinds:

1. Even in the absence of infectious cystitis changes of a catarrhal nature occur in the mucous membrane. The vessels in the floor of the bladder, especially the larger veins, are greatly injected, while the membrane as a whole retains its normal color. An excessive amount of mucus is produced, which floats about in the urine in small flakes and adheres to the mucous membrane here and there, covering it with a grayish veil. Sometimes small floating mucous polyps are seen, particularly on the floor of the bladder. They resemble small papillary villi, are translucent and contain blood-vessels (Zangemeister).

2. Contraction of the cavity by the pressure of the myoma is much more common. The bladder is compressed from above downward or from behind forward, forming a cleft (Spaltblase, Fig. 149, Zangemeister) or the floor of the bladder is elevated (Fig. 148), pushed forward or displaced to one side, one or both ureters being always involved in the displacement. In other cases circumscribed portions of the bladder wall are invaginated by the pressure of myomatous nodes.

Some of the changes which have just been described have much more importance than others as possible causes of urinary symptoms. Contraction of the bladder due to pressure from above rarely gives rise to symptoms. On the other hand, any cystoscopic changes in the floor of the bladder, where uterine tenesmus originates, circumscribed non-infectious catarrh, and moderate displacement of the floor of the bladder may always be regarded as positive findings.

Diagnosis of the Degenerations.

Myomata, the duration of which may extend over several decades until the menopause, when the tumor ceases to grow, or its operative removal, are subject to various kinds of degeneration. The significance of these degenerations varies. While certain structural changes, such as induration and calcification, may have no particular effect on the general condition, others like sarcoma may prove fatal after the disease has been present for years without causing any inconvenience. The degenerations also differ in the fact that some of them do not betray their presence by any clinical signs whatever (such as beginning softening), while others are accompanied by such alarming symptoms (total necrosis) that the change in the situation is recognized at a glance. I shall confine myself to those forms of degeneration in which the diagnosis is important and possible.

The malignant degenerations of uterine myomata are the most important.

Carcinoma does not manifest itself in the form of a degeneration of the uterine myoma; while it is undoubtedly influenced by the tumor it develops independently of it, or may ultimately involve the myoma secondarily. Carcinoma makes its appearance in the cervix and produces the same clinical picture as sarcoma when the uterine body is free from myomata; hence the diagnosis is based on the same principles (see diagnosis of carcinoma). Experience has taught us, however, that cervical carcinoma is often overlooked in cases of uterine myomata, the reason being that the examiner is so much taken up by the discovery of the myoma that he refers the symptoms of carcinoma to the myomatous tumor. This grave error can be avoided by systematically examining the other genital organs without preconceived opinion,

particularly if there are any symptoms pointing to carcinoma. In a few cases the diagnosis of carcinoma of the cervix is rendered impossible by the fact that a large myoma of the vagina renders the cervix inaccessible, and the cancer is discovered only after removal of the myoma.

The diagnosis is much more difficult if the carcinoma develops in the mucous membrane of the uterine body when the latter is the seat of myomata, a condition of affairs which may be expected in 1 per cent. of all cases of myoma, owing to the fact that the symptoms produced by the carcinoma, particularly pain and hemorrhage, do not differ sufficiently from those of the myoma and infiltration of the uterine wall, which belongs to carcinoma, is not conspicuous when the latter contains myomata. Carcinoma of the body is often overlooked unless the cervix happens to be dilated and the carcinoma can be felt directly with the finger.

The diagnostic difficulties are well illustrated in the following twelve cases of myoma complicated by cancer of the body, which have come under my observation.

Four cases were not recognized at all before operation.

In two cases a timely diagnosis was made because the cervical canal happened to be open.

In four cases the diagnosis was made because carcinomatous tissue was unexpectedly found in the scrapings.

In two cases the diagnosis was regularly made by curettage because the symptoms aroused the suspicion of carcinoma.

Hence in only one-third of the cases the diagnosis rested on a secure basis.

The danger of overlooking a cancer of the body may be avoided by bearing the possibility of cancer in mind whenever there are any symptoms that deviate in the least from those of ordinary myoma and resemble those of carcinoma. They are: hemorrhages during the menopause and after coitus; persistent serous discharge (see Chart III); severe pain localized in the uterus, particularly if it recurs at a definite time of the day (Simpson's pains). Whenever symptoms of this kind are present, carcinoma should be suspected and a curettage performed for a microscopic examination. It should be an invariable rule always to subject the scrapings to microscopic examination in cases of myoma, even if there is no suspicion of cancer. By following this rule cancer was discovered in one-third of my cases. If the cervix happens to be dilated, the body should always be examined for cancer by digital exploration.

The complication with **sarcoma** is based on the presence of a corresponding degeneration in the myoma, which may occur in all of the varieties, in about 2 per cent. in subserous, about 4.5 per cent. in interstitial, and about 9 per cent. in submucous tumors. The diagnosis of this degeneration varies in the different forms.

In submucous myoma the diagnosis of sarcoma is difficult because the symptoms are practically the same as those produced by

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the myoma and the physical signs, which are available only when the cervix is dilated, do not differ sufficiently from the signs of simple submucous myoma. If the consistency is soft and friable, and the structure of the tumor irregular and lobulated, sarcoma may be suspected.

As an illustration of the difficulties encountered in the diagnosis I may mention that I correctly diagnosed sarcoma in only one case out of eleven. In all of the other cases the diagnosis was made later by examining the extirpated polyps.

The diagnosis is chiefly made by microscopic examination; with this difference, however, that owing to the absence of any suspicion of malignancy, the examiner does not procure some of the tumor beforehand for examination but has the examination made after the tumor has been removed for a submucous myoma. As sarcomatous degeneration is to be expected in 9 per cent. of the cases, it should be a rule to examine every submucous myoma microscopically after extirpation.

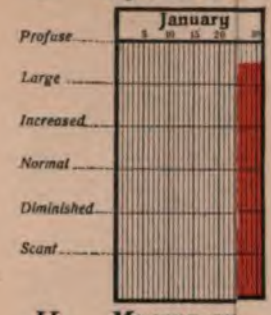
The diagnosis of sarcomatous degeneration of an interstitial myoma is still more difficult because a tumor in this situation is not accessible to direct palpation and the material necessary for microscopic examination cannot be obtained.

Among ten cases of sarcoma in an interstitial myoma I made a correct diagnosis of only one. In all the others the tumors were removed under the impression that they were pure myomata and only later recognized as sarcomatous.

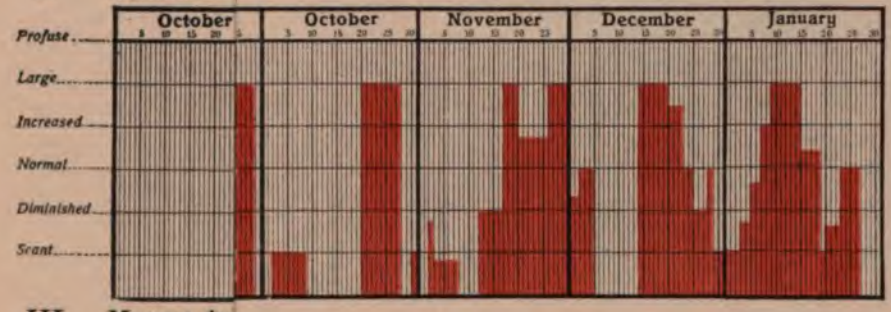
Certain symptoms may arouse the suspicion of sarcoma: hemorrhage during the menopause, irregular metrorrhagias (see Chart IV), intense pain in the tumor independent of menstruation, emaciation and loss of strength when they are not to be explained by hemorrhages or other symptoms. None of these symptoms is, however, absolutely characteristic. The diagnosis rarely finds support in objective signs. The consistency is practically unchanged or may be quite variable; in some cases hard, in others soft. The rate of growth is not perceptibly increased in sarcoma and, if it is noticed at all, it is much more often attributable to cystic degeneration than to sarcoma. Metastases may possibly aid the diagnosis, as, in one of my cases, in the inguinal glands. The diagnosis is necessarily uncertain except in very advanced stages of the disease.

In subserous myoma the conditions are somewhat characteristic on account of the involvement of the peritoneal investment, which not infrequently leads to the production of ascitic fluid and the formation of broad adhesions with adjacent organs; but as these peritoneal symptoms may also occur without sarcoma, the diagnosis must in addition be supported by the other symptoms described in connection with interstitial myoma, particularly the general symptoms.

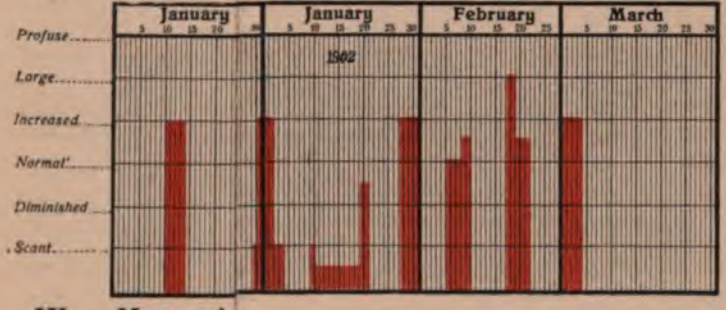
I *Myoma int*



II *Myoma su*

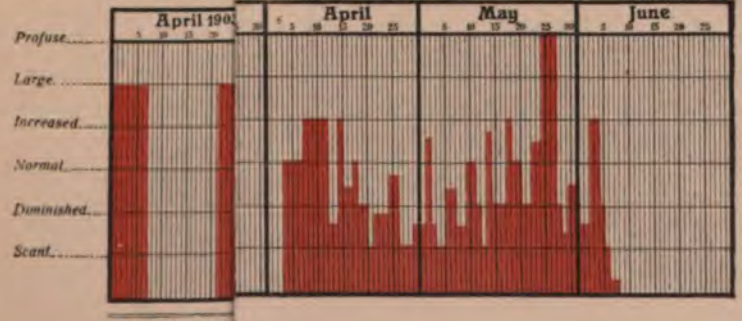


III *Myoma in*



IV *Myoma in*

V *Myoma uthagia due to total necrosis.*



Winter, Diagnosis

Among the benign degenerations the most important is **total necrosis of an interstitial myoma,** because it is attended with pronounced symptoms and may endanger the patient's life if the tumor is not removed in time.

The total necrosis which occurs in submucous myomata during parturition and in subserous myomata when the pedicle becomes twisted is merely secondary to these processes and requires no separate discussion.

Total necrosis of an interstitial myoma produces certain characteristic clinical symptoms which have a diagnostic value. The presence of a dead body in the uterine wall gives rise to reflex labor pains, which have for their object the expulsion of the body. They manifest themselves as severe, intermittent pains localized in the uterus and extending over a period of weeks or months. Along with, and sometimes coincident with the pains there may be hemorrhages, entirely irregular and independent of the menstrual type, and extending over days or weeks (see Chart V). If the process of elimination proves successful and the myoma is expelled into the uterine cavity, decomposition may set in in the myoma with the production of characteristic symptoms and septic fever. Absorption of the albuminous products of degeneration which are formed in the dead myoma sometimes gives rise to symptoms of intoxication—a grayish color, coated tongue, headache, nausea, vertigo, and flaccidity of the muscles (Freund, Sr.). Occasionally, but not always, acetone is found in the urine. As total necrosis occurs most frequently during parturition and in the puerperium, the statement that the above described symptoms have developed at the end of the puerperium is sometimes of diagnostic value.

The information obtained by objective examination is of no value, as total necrosis produces no change either in the consistency or in the size of the tumor. While expulsion toward the cavity is in process, however, the necrotic myoma may occasionally be felt directly through the uterine wall. In short, the diagnosis is based on the clinical picture as a whole and, as the symptoms are quite marked, a correct diagnosis is very often made.

The commonest of all degenerations that occur in myomata is undoubtedly a **softening** of the tumor due to accumulation of fluid in the tissue. If the extravasation of large quantities of blood can be excluded, the occurrence of clinically demonstrable softening can be attributed, as a rule, to the accumulation of lymphatic fluid, rarely in dilated lymph-vessels, more frequently in the lymph-clefts, and due either to stasis or to degenerative processes.

The early stages of softening cannot be recognized because the quantity of fluid is too small. Even after small, multiple cavities have formed in the myoma, the organ usually retains its original consistency;

if, however, large cavities are present or the myomatous tissue is more or less completely replaced by myxomatous material, the softening can be distinctly demonstrated by the fact that the myoma is more impressible and by a kind of spurious fluctuation. Solitary cavities containing fluid may also escape palpation if they are still surrounded by a thick hard mantle of myomatous tissue; but if the cyst approaches the periphery or the surrounding mantle is soft, distinct fluctuation can be felt. Cystic degeneration may be simulated if the myoma contains but little connective tissue, or is covered by a very thick mantle of muscle tissue, or if the tumor is very vascular.

Occasionally a myoma undergoes a sudden and very rapid increase in size as the result of an accumulation of fluid; these are cases in which a hemorrhage is followed by a copious effusion of fluid in the tissue. In all other cases, in which the process is rather one of substitution of myomatous tissue in process of degeneration by fluid, the size of the myoma remains constant or increases very slowly. Hence rapid enlargement is not a positive sign of softening.

The diagnosis of softening has no special value, as it adds nothing to the severity of the condition and does not necessitate a different treatment.

The clinical diagnosis of **adenomyoma** is not without some importance, because these tumors differ somewhat from the ordinary myomata both in respect to the symptoms and the indications for treatment. The two varieties of adenomyoma, those which arise in the uterine mucous membrane and those which are derived from the Wolffian body, cannot be distinguished clinically. In these cases there is often a history of tuberculous taint, delayed puberty, frequent attacks of dysmenorrhea, sterility, violent pain, hemorrhages and bladder symptoms. Objective examination in the case of adenomyoma derived from the Wolffian body reveals the tumor in the posterior wall near the fundus or at the tubal orifices. The signs of infantile uterus and vagina, *i.e.*, small anteflexed uterus with contracted cervix and short narrow vagina (Freund, Sr., v. Rosthorn), are often present. Polano found perimetritic adhesions in 89.5 per cent. of the cases. With the knowledge at present at our disposal a positive clinical diagnosis of adenomyoma is practically impossible.

Diagnosis of Ovarian Tumors.

The term ovarian tumors is applied to a series of degenerative conditions and new formations of the ovary, the most prominent clinical property of which is enlargement of the organ. Swelling of the organ, it is true, occurs also under normal circumstances, as, for example, from retention of fluid in a Graafian follicle and the formation of the corpus luteum, or it may be due to inflammatory conditions of the ovarian tissue, either acute or chronic. But the above conditions usually lead to an enlargement no greater than about half the size of an egg, which may accordingly be taken, in the main, as the boundary between transitory physiologic or inflammatory swelling, and permanent tumors; although it must also be emphasized that the former, in rare cases, may be somewhat larger, and the latter in their early stages occasionally smaller than the above mentioned standard. Accordingly I propose, from the diagnostic standpoint, to include among ovarian tumors all enlargements of the ovary exceeding the size of an egg. They include:

Definition.

A. Non-proliferating cysts (follicular cysts, cysts of the corpus luteum).

B. Neoplasms.

I. Parenchymatogenous tumors (parenchyma = germ epithelium, follicular epithelium and ovum).

1. Epithelial neoplasms.
   - (a) Cystoma serosum simplex.
   - (b) Cystadenoma.
     - (*a*) Cystadenoma pseudomucinosum.
     - (*b*) Cystadenoma serosum.
   - (c) Carcinomata.

2. Ovigenous neoplasms.
   - (a) Dermoids
   - (b) Teratomata } (Embryomata).

II. Stromatogenous tumors.

Fibromata.

Sarcomata.

Peritheliomata and endotheliomata.

Combinations of these different varieties of tumors frequently occur.

Diagnosis and Differential Diagnosis of Ovarian Tumors.

The ovarian tumor is connected to the uterus by a pedicle, and a knowledge of this peduncular connection is of great importance for the diagnosis. The pedicle contains the same elements that connect the

normal ovary with the uterus, *i.e.*, ovarian ligament, tube and broad ligament (Fig. 151). The ovarian ligament retains its original shape more than any other part of the pedicle; although it is occasionally drawn out lengthwise it retains its thickness and firmness, and is that part of the pedicle that represents the palpable, cord-like connection of the tumor with the uterus. The tube may vary considerably in length; sometimes in very large tumors it may

Anatomy of the Pedicle.

FIG. 150.—BILATERAL MALIGNANT OVARIAN TUMORS *in situ*. (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg.) (Original.) The uterus is situated in the middle and gives off a pedicle on each side to the tumor; the pedicle shows the three component parts: in the middle, the ovarian ligament; laterally, the infundibulo-pelvic ligament; and between the two, the tube. The round ligament runs along the lower surface of the uterus.

retain its normal length; in another case it may be greatly elongated even with only moderately large tumors. The length of the tube depends on the relation between the tumor and the mesosalpinx. The more the tumor develops independently of the mesosalpinx and the broad ligament, the smaller will be the part taken by the tube in the formation of the pedicle; and the more the tumor approaches the tube by unfolding of the mesosalpinx, the greater will be the elongation of the tube by the growth of the tumor. The broad ligament, with the vessels, nerves and connective tissue contained between its two layers, represents the greater part of the true pedicle, the lateral free border

of which is formed by the infundibulo-pelvic ligament. The broad ligament may be completely preserved in length and breadth if the tumor is pedunculated and grows only outward; in that case only the mesovarium and a small part of the mesosalpinx are unfolded, and assist in forming the covering of the tumor (Fig. 152_3). The length of the pedicle varies greatly; sometimes it is so short that the finger can barely be inserted between the tumor and the uterus, or its length may be such that the tumor can be pushed under the arch of the ribs. The width is also subject to great variations. A peculiar condition is often found in solid tumors produced by a uniform degeneration of the ovary; the layers of the mesovarium are not separated and are

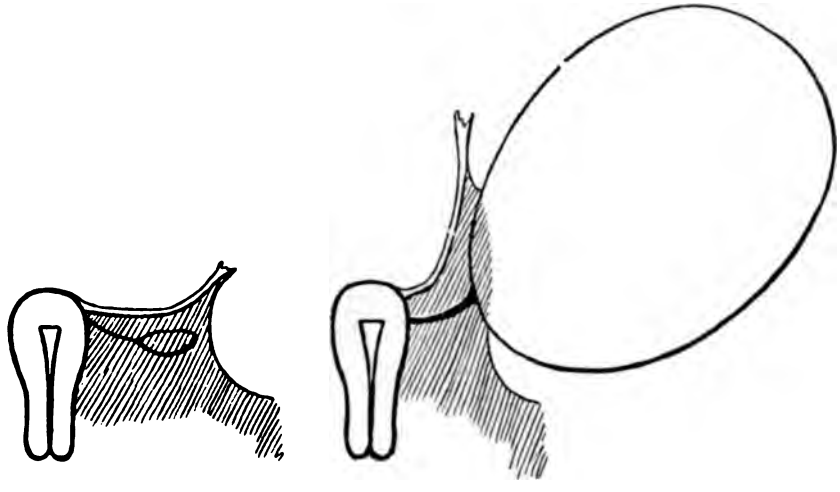


FIG. 151.—RELATIONS OF THE PEDICLE IN A NORMAL OVARY AND IN AN OVARIAN TUMOR. (Schematic.) (Original.) The pedicle is formed by the tube, ovarian ligament and broad ligament; the base of the tumor only is covered by the unfolded mesovarium.

drawn into the hilus of the tumor so that the latter projects beyond the pedicle in all directions, and thus renders the pedicle very short and rigid (Fig. 152_2).

If the ovarian tumor grows toward the mesovarium and broad ligament, it crowds the two layers of the latter apart and pushes in between them. In this way it is completely or partially covered with the peritoneum of the broad ligament and becomes an intraligamentary tumor (Fig. 152_4). Most ovarian tumors exhibit a partial development into the broad ligament, in such a manner that a small part of the base of the tumor is lodged between the layers of the mesovarium and the broad ligament, and the remaining peripheral part develops free. Intraligamentary development is seen most distinctly in parovarian tumors, which usually occupy the lateral portion of the broad ligament, do not separate the layers of the median portion, and draw it out into a kind of pedicle.

Intraligamentary Type.

An intraligamentary ovarian tumor may grow in various directions. It may leave the outer portion of the broad ligament and grow into the retroperitoneal connective tissue to the left, underneath the sigmoid flexure, and to the right under the cecum. Other tumors elevate the posterior layer of the broad ligament and thus reach the posterior pelvic wall, or grow into the loosely attached peritoneum of the posterior uterine wall, and reach the other side; or—much more rarely—they may elevate the anterior layer, and appear in the neighborhood of the bladder, in the preperitoneal cavity of Retzius. In most cases intraligamentary ovarian tumors cause a separation of the

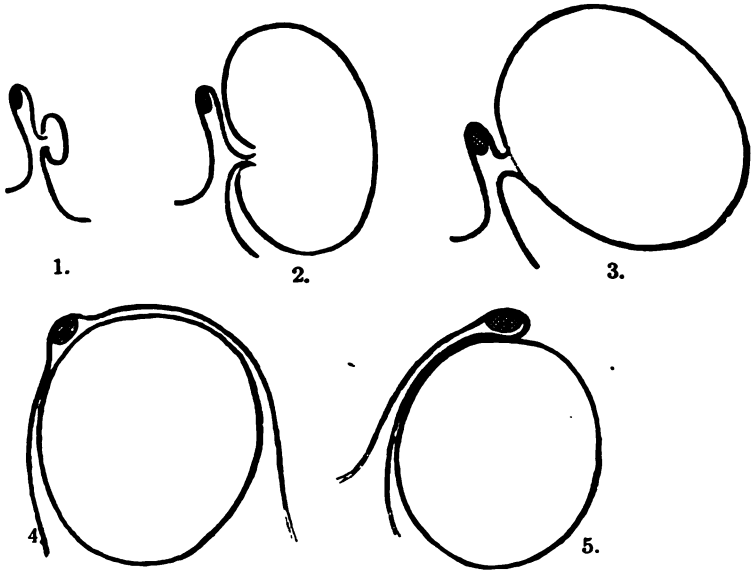


FIG. 152.—RELATIONS OF OVARIAN TUMORS TO THE BROAD LIGAMENT IN SAGITTAL SECTION. (Schematic.) (Original.) 1. Normal ovary. 2. Short pedicle in solid tumors. 3. Ordinary pedicle of ovarian tumors. 4. Intraligamentary type. 5. Retroligamentary type.

median portion of the broad ligament and grow toward the uterus, crowding up close to the lateral aspect, and sometimes even separating the uterine muscle. In such a case they may be situated in the true broad ligament alongside of the body, or they may develop farther down in the parametrium alongside of the cervix, and occupy a position on the vaginal vault.

A situation similar to that of an intraligamentary tumor may be seen when an originally pedunculated ovarian tumor is held fast by adhesions on the floor of Douglas' space and prevented from growing upward. The tumor in that case elevates the broad ligament which covers it, so that the posterior and upper parts of the tumor project free into the abdominal cavity, while in front it is covered by the two layers of the broad ligament, either free or adherent

Retroligamentary Type.

to the tumor; the tube runs along the upper border of the broad ligament over the top of the tumor. This type is called retroligamentary (Pawlik's pseudointraligamentary type, Fig. 152_5).

Ovarian tumors, so long as they are small, are usually approximately round or oval, and may retain this shape as they continue to enlarge if the tumor consists in the main of a single cyst. If, however, several or many cysts take part in the formation of the tumor, it becomes irregular and shows retractions, deep divisions, protu-

Fig. 153.—Ovarian Cyst and Parovarian Cyst of the Same Side. ½. (Original.) (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg.) The ovarian cyst hangs by a pedicle from the broad ligament, between the layers of which a small parovarian cyst has developed. A probe has been passed through the tube.

berances, and tubercles, depending on whether the individual cysts appear on the surface, or the solid portions of the tumor are more conspicuous. A solid tumor may, if its growth is uniform, have an absolutely round or oval shape; others, particularly malignant tumors, owe their enlargement to irregular proliferations of the superficial tissue. The size of the tumor varies within very wide limits, ranging from enlargements the size of an egg, which barely deserve the name of tumor, to an enormous size, distending the abdominal walls to their utmost, pushing the diaphragm upward, causing incurvation of the costal arch, and filling the entire abdomen to such an extent that the rest of the body becomes smaller than the tumor. The

Shape.

consistency of ovarian tumors is by no means uniform; tumors filled with fluids are cystic, while those consisting only of parenchyma or stroma have a solid consistency. This general statement is, however, subject to many qualifications, not so much that solid tumors may have a cystic feel on account of softening as that tumors distended with fluid often do not exhibit fluctuation. This is the case in small cysts containing moderate quantities of fluid with high internal pressure and tense walls; and cystadenomata containing numerous small cysts or colloid material. Pedunculated tumors are movable unless they encroach to such an extent on the abdominal cavity that there is no longer room for movement; on the other hand, ovarian tumors may become immovable by reason of incarceration in the true pelvis, adhesions with neighboring organs, or intraligamentary development. The relations to neighboring organs, especially to the uterus, may be various; so long as the tumors are small they occupy the site of the ovary; as they increase in size, however, and particularly if the ligaments are relaxed, they usually descend into Douglas' space; more rarely they lie in front of the uterus. In their subsequent growth the tumors emerge from the pelvis and approach the anterior abdominal wall, forcing the uterus downward or backward. From this time on they remain constantly in contact with the anterior abdominal wall and gradually become more and more distended.

It appears, therefore, that with regard to shape, consistency, movability, seat, and connection with neighboring organs, ovarian tumors produce such a variety of clinical pictures that it is difficult to define any general or constant properties which might afford a basis for diagnosis. The latter is based practically on the palpation of a peduncular connection between the tumor and the uterus. The method of arriving at a diagnosis differs very much, however, according to the size of the tumor, and for this reason it is advisable to subdivide ovarian tumors for diagnostic purposes as follows:

1. Small ovarian tumors still occupying the true pelvis.
2. Medium-sized tumors which have emerged from the pelvis and appear in the abdominal cavity, but do not much exceed a man's head in size, and certainly have not yet reached the costal arch.
3. Large tumors extending to the costal arch and in direct contact with the liver, spleen and kidneys.

Aside from the difference in the methods of arriving at a diagnosis in these three groups, the classification has the further advantage that the differential diagnosis must take into consideration very different conditions, depending on the size of the tumor. (Many tumors such as

myomata may, depending on their size, be mistaken for ovarian tumors belonging to any one of these three groups; but in order to avoid repetition, the differential diagnosis will be discussed only once in connection with the conditions with which they are most likely to be confounded.)

1. Small Tumors.

Diagnosis. In the case of small tumors that still occupy the true pelvis it is usually not possible to demonstrate a peduncular connection with the uterus; for the uterus and the tumor are usually so close together that the finger cannot be inserted between them, or the pedicle is not sufficiently stretched to permit palpation. Artificial stretching of the pedicle, which is performed in the case of large tumors, is not practicable on account of the small size and limited mobility, and hence it is only occasionally possible to palpate the pedicle by pushing the tumor into the false pelvis and palpating between it and the uterus; in retro-uterine tumors also a cord can sometimes be felt running to the anterior surface of the tumor. But such cases are exceptional; in the great majority of small tumors this textbook sign is not available, and they must be identified as ovarian by their special peculiarities. To begin with, one should try to separate the tumor from the uterus (Fig. 154); either the tumor can be completely separated from the uterus, as in the case of pedunculated tumors, or, if the tumor develops between the layers of the broad ligament, it should be possible to make out a distinct constriction between the tumor and the uterus. The nearer the tumor lies to the uterus, the more difficult it will be to make out this constriction, and in some cases it can be done only by attempting to go in between the two through the vaginal vault alongside of the vaginal portion; above, at the uterine body, the two frequently form a single mass. Retro-uterine tumors are particularly difficult to separate from the uterus if the tumor is firmly incarcerated and in extensive contact with

Fig. 154.—Right-sided Cystic Ovarian Tumor (from a preparation in the Kgl. Universitäts-Frauenklinik in Berlin). ⅓. (Original.) Douglas' space contains a movable, round cystic ovarian tumor of the right side, which has crowded the uterus to the left and forward. In front of it is the bladder; part of the right tube can be seen in front of the tumor; the left adnexa are normal.

Diagnosis.

the posterior wall, or intimately attached to the wall by adhesions and exudates; but even under these circumstances the examiner should attempt to separate the round contour of the tumor from the uterus and to exclude any peduncular connection, such as belongs to myomata and tubal tumors. The shape of an ovarian tumor is approximately globular or oval; the surface is usually smooth and sometimes retracted at various points (Fig. 155). Lobulations and protuberances are found in solid tumors, and occasionally also in dermoids. The cystic consistency of small ovarian tumors is usually not recognized; as a rule, they give the impression of a solid tumor on account of the great tension of their walls and the small amount of contents, particularly when the walls are thick; thin, solid, flabby tumors are more easily recognized

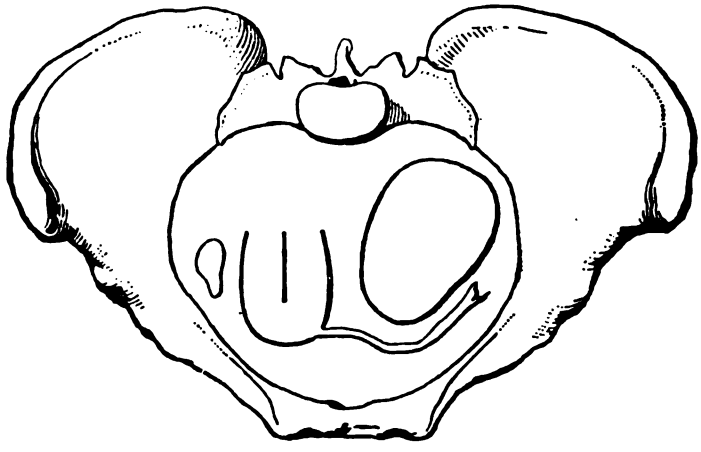


FIG. 155.—LEFT-SIDED OVARIAN TUMOR. P.-F. ⅓. (Original.) Follicular cyst of the left ovary the size of a goose-egg, with dextro-position of the uterus. The entire length of the left tube is distinctly felt in front of the tumor. The right ovary is normal.

as cystic. It is only by grasping the tumor firmly between the fingers and making forcible but cautious pressure at opposite points that fluctuation can be elicited. Solid ovarian tumors of this size are much more rarely seen. The position of the tumor at once points to an ovarian origin. If it is found at the site of the ovary, we need not hesitate under such circumstances to pronounce it an enlarged ovary. Small ovarian tumors are most frequently found posteriorly, alongside the uterine body, or they descend into Douglas' space and form a retro-uterine tumor with anteposition of the uterus. Intraligamentary tumors are situated exactly to one side, and somewhat behind the uterus. Movable ovarian tumors are more rarely found in front of the uterus than any others. Among these anteuterine tumors, dermoids are conspicuous by their frequency.

Differential Diagnosis. The first difficulty encountered in the interpretation of these small ovarian tumors is in distinguishing

them from inflammatory swelling of the ovary. In chronic oophoritis the ovary, it is true, rarely exceeds the size of a pigeon's egg and is distinguished from true ovarian tumors by its great sensitiveness to pressure, and occasionally also by the presence of complicating inflammatory processes in the neighborhood. Acute oophoritis, on the other hand, may lead to the formation of larger tumors. As a rule the fever, the extreme tenderness, the accompanying pelvic peritonitis, and the history or the presence of an infection as the cause, will indicate the correct diagnosis. The difficulties of this differential diagnosis are illustrated by the following case:

Differential Diagnosis of Small Tumors. Oophoritis.

Case 23. A patient, 21 years of age, had been curetted twenty-six days previously and three days later developed fever up to 40.4° C. (104.7° F.), with chills. There was found to the left and behind the small anteflexed uterus, in Douglas' space, an apparently solid ovarian tumor quite as large as the fist. As it was entirely painless and movable it was regarded as a dermoid cyst. On extirpation, however, it was found to be an ovary enlarged as the result of edematous infiltration, with an abscess a little larger than a walnut; there were no signs of inflammatory redness on the surface or in the surrounding tissues.

The differential diagnosis between ovarian tumors and myomata is important, and often very difficult to make. The two neoplasms are often mistaken for one another even by the most practiced diagnosticians, because they have certain properties in common. If the examiner depends on one of these properties without taking the picture as a whole into consideration, he runs a great risk of making a false diagnosis. The palpatory findings alone should form the basis for diagnosis. Symptoms are of no value whatever in arriving at a decision; the development of the tumor at an early stage is, of course, in favor of ovarian tumor, but it is not a reliable factor, just as the appearance and growth of a tumor after the menopause merely excludes myoma with a certain degree of probability. Very rapid growth is in the main more in favor of an ovarian tumor, while a slower development points to myoma. A positive conclusion, however, must be arrived at by bimanual examination. It is obvious that subserous myomata with rather thin pedicles are most apt to be found with ovarian tumors. Interstitial myomata, while small, are easily recognized; but if they form large tumors they may also be occasionally mistaken for ovarian tumors, and *vice versa*. The most important point of distinction is the consistency. It may almost be stated as a general principle, that solid tumors are myomata and cystic tumors ovarian, although myomata may, as a result of various conditions, become so soft that they exhibit fluctuation; while, on the other hand, solid ovarian tumors are not so very rare, and even cystic ovarian tumors may be very hard to the touch, as, for example, thick-walled dermoid cysts and parvilocular cystomata. But these are all exceptional conditions, and while they may limit the scope of the above general statement, they are not sufficient to invalidate it. A

cystic consistency is always the main support of a diagnosis of ovarian tumor. The diagnostic errors, which not infrequently rest on a misinterpretation of this property, are due not so much to incorrect interpretation of a correctly recognized consistency, as to mistakes in observation, the consistency not being correctly recognized. If the abdominal wall is thick, and coils of intestine are in contact with it, or if the tumors have thick walls, it is difficult to estimate the consistency. The best method consists in grasping the tumor with both hands at two as nearly opposite points as possible, and compressing the tumor by a series of short pushing movements. If the tumor is seated deep in the pelvis it is unquestionably easier to test the consistency by examining through the rectum. After the consistency of the tumor has been demonstrated, its connection with the uterus must be investigated. Pedunculated ovarian tumors have only a thick, membranous pedicle which either cannot be felt at all, or may just be recognized by the ovarian ligament when the uterus is forcibly drawn downward. Myomata, on the other hand, usually have a pedicle which is much thicker than the ovarian ligament, shorter, with a more fleshy feel, broader and more distinct; although they also occasionally have only a very thin pedicle. If the pedicle is joined to the fundus or some other portion of the body where the uterine ligament cannot be inserted, the tumor is probably a myoma. Another point in favor of myoma is the failure to identify the tube as part of the pedicle. The best method of palpating the pedicle is that proposed by Schultze and Hegar (see page 305). The examination is much more difficult when the abdominal walls are thick, and the organs to be palpated deeply situated. The difficulties of making out a pedunCular connection are still greater in intraligamentary tumors. As a rule, these ovarian tumors grow only toward the uterine wall, so that a constriction can everywhere be distinctly demonstrated; while myomata always have a fleshy connection with the uterus, although in very rare cases an intraligamentary myoma may be completely separated from the uterine wall. It may, however, be very difficult to isolate the uterus if, as is often the case in senile women, the organ is flat and long-drawn-out and in close contact with the tumor. On the other hand, ovarian tumors may have such a vigorous growth that they force the uterine wall apart and create a covering of muscle for themselves at this point, representing tumors with a broad connection with the uterus, like broadly sessile, subserous myomata.

CASE 24. Mrs. H. Uterus in correct elevation; to the right, a tumor as large as a child's head; to the left, another as large as a man's head, with an extensive attachment to the uterine wall. Nine months ago a diagnosis of subserous myoma was made by one of the first gynecologists in Germany. At the present time, in spite of the broad connection with the uterus, a positive diagnosis of bilateral ovarian tumor can be made, because the consistency is everywhere distinctly cystic. At the operation both tumors had to be peeled out of the uterine wall with a knife, leaving a wide depression on each side of the organ.

Mensuration with the sound plays an important part in the differential diagnosis between myomata and ovarian tumors, inasmuch as there is always a certain increase in the length of the cavity with myoma—with the exception of myomata that have very thin pedicles and a uterus everywhere free from myomata—whereas, in the case of ovarian tumors the length of the cavity is not as a rule increased. Nevertheless, in the case of rapidly growing intraligamentary ovarian tumors a thin uterus may be drawn out to such an extent that the sound yields a measurement of 10 to 12 cm. The detection of the adnexa by palpation may occasionally decide in favor of myoma in doubtful cases, provided the two normal ovaries can be felt beyond the possibility of a doubt; as a rule, however, this is not possible, because in the case of subserous myomata the ovaries are displaced to such an extent that they are not accessible to palpation. The round ligaments are very welcome signs, pointing to interstitial myoma if they can be traced up over the dome of the tumor. In subserous myomata they do not have such diagnostic value because they do not necessarily pass over the tumor. In intraligamentary myomata and ovarian tumors the behavior of the round ligaments may be identical, because the ligament in the case of every tumor developing in the lower portion of the broad ligament passes obliquely over the tumor toward the anterior layer and ends in the fundus. A distinct uterine bruit may occasionally serve to clinch the diagnosis of myoma as against ovarian tumor.

Special difficulties are encountered in the differential diagnosis between intraligamentary ovarian tumors and other kinds of tumors developing in the same manner, because the broad ligament loses its characteristic properties by its investment with connective tissue and peritoneum, and its connection with the uterus is particularly difficult to palpate. Tumors of this kind are: tubal tumors, hematomata and exudates. Small, multilocular, papillary tumors are particularly difficult to recognize because fluctuation is not distinct, and their round shape is obscured by the numerous projecting divisions and the often inflamed and thickened ligament which covers them. Exudates are distinguished by their diffuse shape, rarely round, hard consistency, and broad connection with the pelvis. Hematomata have a greater resemblance to ovarian tumors because they are more round and of soft consistency. They are distinguished from ovarian tumors, however, by their irregular shape and the zone of reactive infiltration in the surrounding connective tissue, especially in the case of older tumors. By keeping the patient under observation for a time many a doubt may be cleared up; for exudates and hematomata gradually disappear, while ovarian tumors continue to grow. Intraligamentary tumors, whether tubal or ovarian, are often

Intraligamentary Ovarian Tumors.

indistinguishable by any diagnostic method. (For the details see chapter on Parametritis and Diseases of the Tubes.)

For the differential diagnosis from hydrosalpinx, see the latter.

When the tumor is situated behind the uterus (Fig. 156) it may be confused with a retro-uterine hematocele or pelveo-peritonitic exudate —conditions which may be distinguished from one another by certain definite points, while, on the other hand, they possess certain common properties which place them in the same class as against ovarian tumors.

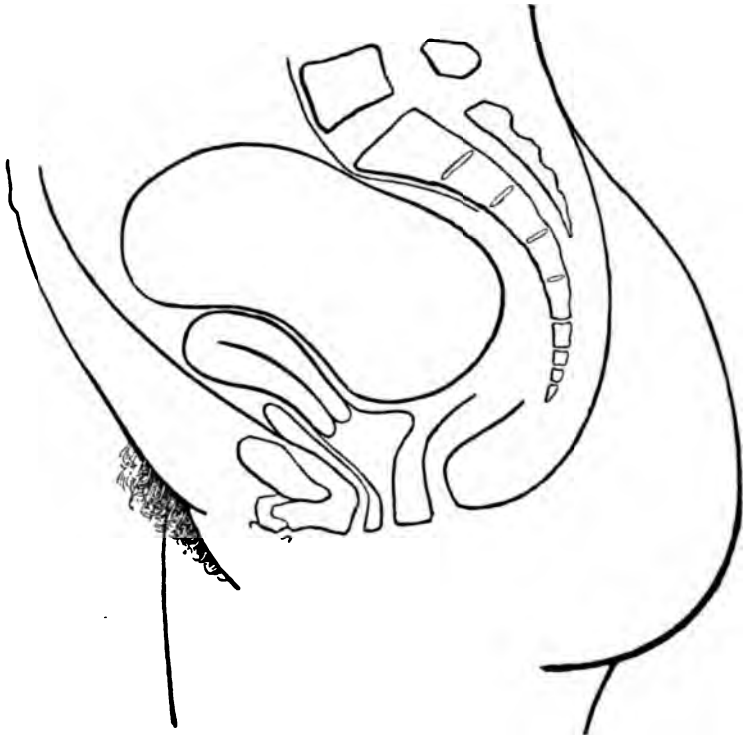


FIG. 156.—RETRO-UTERINE OVARIAN TUMOR. P.-F. ⅓. (Original.) An ovarian tumor the size of a small man's head; uterus in anteposition; tumor and uterus can be wholly separated from one another.

(For the differential diagnosis see pelveo-peritonitic exudate.) There is less likelihood of confusion with retroflexion of a gravid uterus because the consistency of the gravid uterus alone is quite different, although it must be admitted that an incarcerated uterus at the beginning of the third or fourth month may lose its characteristic softness and develop a tense consistency similar to that of an ovarian tumor. As a rule, the diagnosis of retroflexion of a gravid uterus can easily be made by determining the junction between the vaginal portion and the uterus; and if it is not possible, the above mentioned signs of pregnancy, the history, and observation of the patient must be utilized in making the diagnosis.

Retro-uterine Ovarian Tumors.

2. Medium-Sized Tumors.

Diagnosis. The demonstration of a tumor in such cases usually presents no difficulty. The conical protrusion of the abdomen renders its presence probable, and by means of percussion and palpation it can usually be demonstrated beyond a doubt. With tumors of this size there is less danger of being deceived by an accumulation of fat or meteorism, which may simulate a tumor, than in the case of very large neoplasms, because these conditions cannot be limited to a circumscribed portion of the abdominal wall. If the existence of a tumor has been positively demonstrated, its position at the pelvic inlet will at once suggest its origin in the genitalia, while the demonstration of a distinctly cystic consistency will point to the ovary. But in these tumors also the chief point in the diagnosis is the demonstration of a connection with the uterus—the feeling of a pedicle. The distinctness with which the pedicle can be demonstrated will depend on its position and the firmness of the component tissues. In order to feel the pedicle the external hand, with or without the internal hand, is pushed down between the cornu of the uterus and the tumor. When the uterus is anterior and in front of or underneath the tumor, and the pedicle is firm, the latter can be felt merely by passing the fingers of the external hand to and fro in a direction vertical to the course of the pedicle, but not under any other circumstances; in most cases, however, the pedicle is too flabby or too far away from the abdominal walls to be palpated with certainty from the outside. Palpation is most difficult when the uterus is behind the tumor. In the great majority of the cases a special method of examination is therefore necessary in order to demonstrate the pedicle with certainty. This consists in stretching the pedicle artificially by grasping the vaginal portion with a double tenaculum and drawing the uterus forcibly downward (Hegar). Internal examination must in that case always be made per rectum because vaginal exploration is impossible on account of the inversion of the vagina which accompanies the drawing down of the uterus. The patient should be anesthetized, and two fingers introduced as high as possible into the rectum, while the external fingers are passed to and fro between the cornu of the uterus and the tumor in a direction perpendicular to the course of the pedicle. Demonstration of the pedicle may be rendered easier by having the assistant force the tumor upward (Schultze), and bring down with the external hand as much of the abdominal wall as possible, so as to press the hand deep down into the abdomen (Fig. 157). In most cases demonstration of the pedicle serves to show at the same time from which horn of the uterus it originates, and thus indicates which side the tumor belongs to. This part of the diagnosis may be confirmed by the demonstration of a sound ovary on the other side

Diagnosis.

and the waxy tenacity of the outer wall of the uterus. While the cyst is in the lowest pole it moves as less freely as the short pedicle

FIG. 157. Position of the Hands in Palpating the Pedicle of an Ovarian Tumor. 1, Original; 2, the examining intermediate two fingers of the left hand into the pedicle, and with the right bringing down enough abdominal wall to enable them to make sharp pressure with the fingers; the assistant with one hand draws the uterus down with a double tenaculum, and with the other forces the tumor upward in order to put the pedicle on the stretch.

Positive demonstration of a pedicle is the best protection against diagnostic mistakes. In senile, atrophic cases I have sometimes failed to recognize the pedicle on account of the tenuity of the tissues.

Difficulties arise when the pedicle is so short that the hand cannot be introduced between the uterus and the tumor, or when adhesions connect the two, or the tumor has developed between the layers of the broad ligament. In such cases an attempt should be made at least to isolate the tumor from the uterus and to base the diagnosis on the general characteristics of the tumor, particularly its shape and consistency.

The **differential diagnosis** of these medium-sized tumors embraces a larger field than that of the smaller neoplasms that still occupy the pelvis, because tumors of individual abdominal organs and of the abdominal walls must also be considered. The foundation of the differential diagnosis in every instance must be the demonstration of a pedicle, and next in importance are the properties of the tumors, which may aid in arriving at a decision.

Differential Diagnosis.

Differential diagnosis from encapsulated ascites or peritoneal exudate. While free ascites rarely produces sufficient tension of the abdominal walls to be confounded with ovarian tumors—and in any case only with very large ones—encapsulated ascites may, on the other hand, form a circumscribed tumor of cystic consistency. In peritoneal diseases, such as chronic inflammatory conditions, a quantity of fluid frequently becomes encapsulated between the intestinal coils and the anterior abdominal wall. These collections of fluid may by their cystic consistency resemble an ovarian tumor, such as a multilocular cyst, which may be simulated by the presence of metastatic or inflammatory thickening in the neighborhood. The distinction between these tumors and ovarian neoplasms is difficult because, owing to the general adhesions, the uterus cannot well be isolated, and it is never possible to feel a pedicle; on the other hand, their shape and boundaries are often quite distinctive. In ovarian tumors, even when they are thin, solid, and surrounded by adhesions, it can be determined by palpation that the tumor is bounded by its own wall; whereas encapsulated exudates do not exhibit a round contour separating them from the intestines, but instead merge gradually with the surrounding inflamed and thickened tissues. The shape of encapsulated exudates is flat, rarely round or oval, and there is not much protrusion of the abdominal wall. Sometimes the demonstration of nodules in the peritoneum, or of collections of fluid encapsulated in other regions, establishes the diagnosis of peritonitis. The percussion note over ovarian tumors is distinctly dull, while encapsulated exudates, owing to the adherent coils of intestine, often give a modified tympanitic note. Occasionally the diagnosis of ascites may be made by the symptoms of peritoneal disease of long standing.

Encapsulated Peritoneal Exudates.

CASE 25. Mrs. N. Uterus small and in anteversion; 6 cm. There is a tumor extending upward two fingers' breadth above the umbilicus and beyond the median line on both sides; below it extends into the pelvis behind the uterus; connection with the uterus is demonstrated with difficulty. As the tumor feels smooth, has a cystic consistency, and is moderately movable, it is regarded as an ovarian tumor. At the operation there was found underneath the omentum and between the coils of intestines an encapsulated tuberculous ascites with miliary nodules on the adjacent peritoneum.

Tumors of the abdominal wall are apt to be confused with ovarian tumors only when the latter are broadly and closely adherent to the abdominal wall. The most important conditions to be considered are exudates in the retroperitoneal connective tissue of the anterior abdominal wall, and fibromata of the abdominal walls; both usually have a very hard consistency, which distinguishes them from cystic ovarian tumors. Furthermore, even in the presence of firm adhesions, a round outline is always in favor of an ovarian tumor, whereas exudates are more flat and usually end above in a sharp edge, are lost below in the pelvic tissue, and have a broad surface of attachment to the uterus. A lateral position is more in favor of exudates; a median position, of ovarian tumors; even when extensive suppuration has destroyed the hard consistency of the exudate, the absence of a round contour is against a tumor. Fibromata of the abdominal walls originate either in the fascia of the internal oblique or transversalis muscles, particularly at the crest of the ileum, or in the posterior layer of the sheath of the rectus. Fibromata originating in the latter situation are usually so small and so superficial that confusion with ovarian tumors is hardly conceivable; on the other hand, fibromata of the internal oblique represent larger tumors which, on account of their round shape, may resemble an ovarian tumor—of course, owing to their hard consistency, a firm ovarian tumor. If the tumor is cystic, it is probably not a fibroma of the abdominal walls, even if the situation is typical. If the tumor has grown outward and forms marked prominences, it is probably a tumor of the abdominal wall; if it is deeply situated and develops more toward the abdominal cavity, it may be assumed to be intra-abdominal. Occasionally a direct connection between the tumor and the abdominal muscles can be demonstrated by putting the abdominal walls on the stretch and elevating the patient; or, if the abdominal walls are flabby, it may be possible to grasp the tumor with both hands from behind. In all doubtful cases it is needless to say that the demonstration of a peduncular connection with the uterus, or the finding of two normal ovaries, is conclusive.

Tumors of the Abdominal Wall.

Fibromata of the Abdominal Walls.

Omental tumors may occasionally be confounded with ovarian tumors if they extend into the pelvis. They are, however, usually flat, resembling a shield, and are characterized by their great rotability in

various directions. In one case Benckiser was able to rotate an omental tumor so far upward that the posterior surface could be felt. According to this author, it is always possible in cases of omental tumor to demonstrate a process going to the spleen. The absence of connection with the genitalia, in this case also, is against an ovarian tumor.

A distended bladder may easily be mistaken for an ovarian tumor because the position, shape, contour and consistency all combine to produce a resemblance. The bladder, to be sure, is usually much more flabby, but it may become quite tense if it is greatly distended; it is usually somewhat sensitive to strong pressure. A distended bladder is not as freely movable as a pedunculated tumor, because when the organ is overfilled most of it is extraperitoneal. An error in diagnosis is usually made if there is no retention of urine, and the patient has dribbling instead, particularly if the walls of the bladder are thickened by chronic cystitis. One who lacks experience in diagnosis is advised to use the catheter in all doubtful cases.

Distention of the Bladder.

Echinococcus sacs are frequently mistaken for ovarian tumors, particularly if they occupy the pelvis and grow close to the uterus. Their similarity consists in the fact that they are also distinctly round and fluctuating; as a rule, however, they are much more tense, and their walls are thicker than those of ovarian tumors; they also exhibit unusually thick adhesions with the surrounding tissues. They are often multiple, and in that case appear in a situation where no ovarian tumors could be present. Other points in favor of echinococcus sac are the combination with tumors of the liver, a very slow rate of growth and the statement that an operation has been performed at some previous time for the same disease.

Echinococcus Sacs.

Case 26. Mrs. H. The uterus is in anteposition, and displaced to the left and forward by a tense tumor the size of a fist, situated to the right and behind the organ. The tumor can be differentiated from the uterus and has many adhesions with the surrounding tissues. Although the tumor gave the impression of an ovarian cyst, although no other tumors could be demonstrated in the abdomen, a diagnosis of echinococcus was made because the patient had already been operated on twice for the same disease. Operation confirmed the diagnosis.

The differential diagnosis between ovarian tumor and pregnancy represents a realm of extraordinarily frequent diagnostic errors. The number of cases in which the diagnosis of pregnancy was not definitely made until the laparotomy is very considerable. The error is usually due, in the first place, to the patient's delusion that she is pregnant because of the increase in the size of the abdomen and supposed fetal movements. The physician, being uncertain in his mind, accepts the patient's theory, mistakes nodules on the tumor for fetal parts, and thinks he hears heart sounds. As the uterus cannot usually be outlined by bimanual examination, he mis-

Pregnancy.

takes the entire tumor for the uterus. If, in addition, there happens to be intermittent or irregular menstruation, the mistake is even more easily made; but the fundamental cause of the error is the superficial examination for fetal parts and heart sounds. During the first half of pregnancy, when the fetal sounds are absent, mistakes of this kind are of course much more easily possible. They occur chiefly in cases with a markedly anteflexed gravid uterus in the fourth or fifth months, simulating an ante-uterine, roundish, soft and cystic, hence ovarian tumor, because it is not easy to decide whether the vaginal portion, which is displaced far backward, merges with the tumor or with the uterus which lies behind the tumor; a marked softening of the lower uterine segment is responsible for this mistake. It is only by examining high up in the rectum, or passing the fingers along the lateral wall of the cervix to the uterine body, that it is possible to confirm or exclude junction of the vaginal portion with the tumor. In other cases it is an intraligamentary ovarian tumor with a broad attachment to the uterus that simulates uniform enlargement of the organ and, owing to the cystic consistency, suggests the tumor of pregnancy. In the third and fourth months the conditions are particularly favorable for such a mistake. In such cases it is not always safe to assume the presence of a tumor alongside of the uterus if the vaginal portion merges, not with the middle, but with the lateral aspect, as this also occurs in pregnancy with irregular protuberances of the body and with lateral deviation. The difference in the consistency between the hard uterus and the cystic intraligamentary tumor may also be observed in a similar manner when the softening of the pregnant uterus is irregular; on the other hand, the sign of mobility of the uterus on the tumor is much more reliable. If the two ovaries can be palpated, and the junctions of both round ligaments with the tumor are demonstrable, pregnancy is of course definitely established. With regard to the value of the history in this differential diagnosis, the reader is referred to what has been said under the head of pregnancy. Keeping the patient under observation for several weeks will clear up any doubt that may remain.

During the second half of pregnancy confusion with ovarian tumors is possible only if none of the fetal signs are available, as, for example, in the case of a dead and macerated fetus, and in cases of hydramnion. If the latter has caused great distention in the uterus, the consistency may be distinctly cystic, and if the junction of the vaginal portion with the uterus cannot be demonstrated, the tumor is very apt to be mistaken for an ovarian tumor. The best way to guard against confounding these two conditions is by examining through the vagina or through the rectum and demonstrating a connection between

the vaginal portion and the uterus, or the absence of a normal uterus. The thickness of the wall is also a point in the differential diagnosis, inasmuch as even in the most extreme degrees of distention the wall of a hydramniotic uterus is still considerably thicker than that of an ovarian tumor. An attempt should also be made to trace the course of the round ligaments; if they merge with the tumor, the latter is the uterus. In the same way, if the sacro-uterine ligaments are lost in the tumor, it is certainly the uterus. A distinct uterine bruit is in favor of pregnancy. If the objective signs are not sufficient to yield a positive interpretation, the history may be utilized.

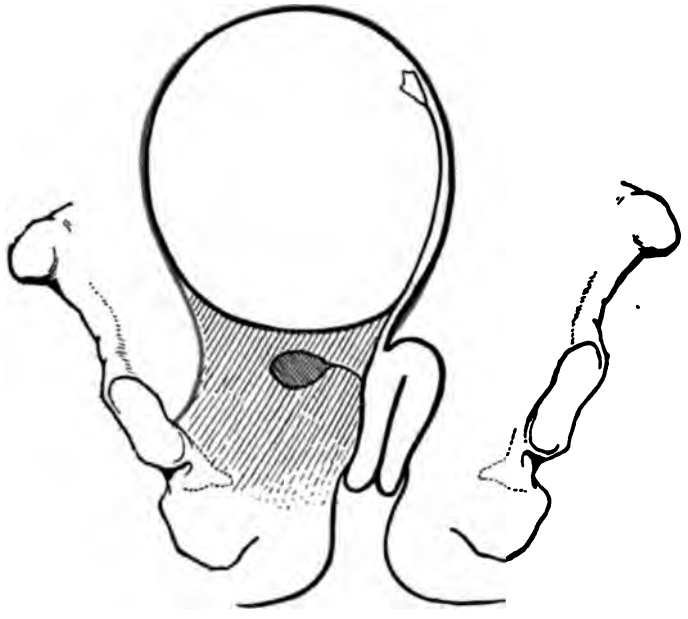


FIG. 158.—RIGHT-SIDED PAROVARIAN CYST. P.-F. ⅓. (Original.) A cystic, very movable tumor the size of a child's head. The right tube can be traced far up on the tumor; within the pedicle the right ovary can be plainly palpated. The red line indicates the peritoneal covering.

Extra-uterine pregnancy is more likely to lead to confusion with ovarian tumor than intra-uterine, because the uterus can be distinctly isolated from the cystic tumor; or, if the two are closely adherent, the tumor at least forms an interruption in the contour of the tumor and can be recognized by its fundus. As a rule, the tumor can be recognized as a gestation-sac by the fetal signs, which are distinctly perceptible; in cases of fetal death or intra-ligamentary pregnancy this diagnosis is, however, more difficult. In most cases the signs of softening will at once suggest pregnancy; softening persists for some time after the death of older fetuses. Changes in the breasts are rarely wanting. If, in addition, it is borne in mind that in the case of advanced extra-uterine pregnancy the history always

Extra-uterine Pregnancy.

contains certain characteristic data (amenorrhea, signs of pregnancy, discharge of the decidua), there will be no lack of distinguishing features.

An absolutely positive distinction between ovarian tumor and parovarian cyst is possible only in exceptional cases. Parovarian cysts, which originate in the canaliculi of the epoöphoron, are usually unilocular, thin-walled, flaccid, with clear, serous contents. The cysts are always intraligamentary between the tube and the ovary; the tube is greatly drawn out and in close contact with the cyst, while the ovary can occasionally be outlined at the base or in the pedicle (Fig. 158). They grow slowly and are seen most frequently in young persons. The differential diagnosis is based chiefly on feeling the ovary alongside of the cyst; if this fails, the above mentioned properties may be utilized.

Parovarian Cysts.

For the differential diagnosis from renal tumors, see the latter.

3. Large Tumors.

Diagnosis. The large ovarian tumors represent neoplasms which distend the entire abdomen; they lie upon the pelvic inlet, extend up to or underneath the arch of the ribs, on either side to the region of the kidneys, and are in contact with the liver, spleen and stomach. They are usually large growths, clinically known as unilocular cystadenomata. In these tumors also the diagnosis depends on the demonstration of the pedunculated connection with one horn of the uterus; but, owing to the great tension of the abdominal walls and the close apposition of the tumor to the uterus, it is usually impossible to carry the external hand down far enough to differentiate the tumor and feel the pedicle. On the other hand, the diagnosis is practically established if it is possible to demonstrate a circumscribed tumor of cystic consistency, as other organs rarely give rise to cysts of the same dimensions. The tumor itself must of course be demonstrated by palpation, which is possible if some parts of the wall are firmer than others. As it is often difficult, on account of the tension of the abdominal walls, to feel a thin cyst wall, percussion must be resorted to more frequently in mapping out the outlines than is the case with medium-sized tumors. In general, it may be said that, by percussion, we determine the dulness over the tumor and the normal intestinal sound in the two lumbar regions.

In the **differential diagnosis** we must consider first of all the conditions which are capable of producing similar large tumors, or at least of simulating such tumors. The first of these to be considered are the so-called pseudotumors. A thick panniculus adiposus, brawny edema of the abdominal walls, severe meteorism, or marked bulging of the abdomen when filled with air—a condition which hysterical subjects are capable of producing

Differential Diagnosis.

FIG. 159.—MULTILOCULAR OVARIAN CYSTOMA. For this illustration I am indebted to Professor Unterberger of Königsberg, who removed the tumor in 1898. The largest circumference of the abdomen was 150 cm.; the contents, which were removed in three sessions, weighed about 50 Kg.; the cyst itself weighed 2.75 Kg

by artificial lordosis—may simulate a large tumor. Percussion is often deceptive because it is impossible to bring out the intestinal sound through the thick abdominal walls. Considerable force must always be used in percussing. If the subcutaneous fat is well developed, palpation is particularly likely to deceive the examiner when the fat ceases above the umbilical region in a marked bulging of the abdomen which makes it appear like the dome of a tumor; in most cases of this kind it is impossible to determine the outline of a tumor, and an increased tension of the abdomen is all that can be made out. In all doubtful cases there is no better diagnostic resource than general anesthesia, when the absence of a tumor can easily be demonstrated by forcibly depressing the abdominal walls in palpation.

Pseudotumors.

Free ascites often simulates very large ovarian cysts, and the distinction between the two conditions may be fraught with various difficulties. A single manipulation of the abdomen may suffice to make the diagnosis, or it may be so difficult that all the diagnostic means at our command are inadequate to clear up the case. I have seen a very large number of cases in which a positive diagnosis was only made at the operation. The diagnostic methods employed for distinguishing between these two conditions are as follows:

Free Ascites.

Inspection in cases of ascites shows a flat abdomen distended in a transverse direction, because in the horizontal position the fluid collects in the lumbar regions, which usually bulge, and the middle of the abdomen becomes distended only when the accumulation is very great. Tumors, on the other hand, particularly the movable ovarian cysts, occupy the middle of the abdomen and cause an increase in the sagittal diameter, while the lumbar region is only moderately enlarged by the distended intestines. Occasionally a shallow constriction may be made out between the two prominent portions. The typical shape of the ascitic abdomen requires for its production a certain softness and yielding quality of the abdominal walls, and is therefore most distinctly seen in multiparæ, while in the firmer abdominal walls of nulliparous women a transverse distention of the abdomen is much less distinctly developed. In the presence of an abdominal tumor the conical shape of the abdomen is not affected by a change of position, whereas in ascites the protrusion becomes greater in the dependent parts, and the more superficially situated portions are flattened. Irregular enlargements of the abdomen indicate a protrusion due to individual portions of the cyst. In free ascites the shape of the abdomen is uniform, and in encapsulated ascites the affected part appears more prominent than the rest of the body. Sometimes the shape of the costal arch may be of diagnostic value, inasmuch as the costal border becomes everted in large tumors

Inspection.

that have forced their way into the lower aperture of the thoracic cage, whereas in ascites the shape of the costal arch is not affected. A typical tumor belly is shown in Fig. 159.

The differences between ovarian tumors and ascites obtained by percussion are much more important. Freely movable ascites in the recumbent position collects in Douglas' space and in the lumbar region, and the boundary between the ascitic dulness and the tympanitic intestinal sound is represented by a horizontal line, which in moderate degrees of ascites is found in front, above the symphysis, and in the sides approximately in the anterior axillary line. The level of this boundary line rises in direct proportion with the quantity of ascitic fluid; but there is always some tympany at the centre of the abdomen because the intestines float in the ascitic fluid and collect at this point. When the quantity of ascitic fluid is large, the zone of intestinal tympany becomes narrower and narrower, but until the end there remains some tympany at the umbilicus and above the umbilicus toward the stomach; finally, in extreme degrees of ascites the intestinal tympany disappears altogether because the intestines can no longer reach the surface of the fluid. The time of the occurrence of this latter phenomenon will depend on the length of the mesentery. In chronic peritonitis with adhesions in the mesentery it occurs very early, and the percutory signs in such a case may be similar to those produced by a tumor, particularly as the intestinal coils in the lumbar regions are prevented by the contraction of the peritoneum from getting out of the way of the ascites, and a tympanitic intestinal note is therefore obtained in that region. In ovarian tumors the relation between dulness and intestinal tympany is exactly the reverse. The movable tumor comes in contact with the abdominal walls near the middle of the abdomen, producing a dull note at that point; while on each side, in the lumbar regions, and above, the percussion note is tympanitic. The larger the tumor, the greater the extent of the dulness; while the zone of tympany disappears above and finally can be demonstrated only in the lumbar regions. In order to determine the boundaries between tympany and dulness, which is the object of percussion, we begin at the highest point of the abdomen, because at that point we are most certain to get a resonant note in ascites and a dull note in the case of a tumor; from this point we percuss downward toward the symphysis, and on each side well into the regions of the kidneys, using very little force and marking the boundaries as they are obtained. In typical cases the findings are so clear that percussion alone suffices to establish the diagnosis. Deviations from the normal findings are, however, quite frequent. Thus, for example, tympany may be found in the lumbar regions, even in the presence of ascites, either because the intestines are very much distended with gas

and push the fluid to one side, or because the ascitic fluid cannot make its way into the lumbar regions on account of adhesions between the intestinal coils and the abdominal wall, as, for example, in carcinomatous or tuberculous peritonitis; on the other hand, tympany may be absent in the lumbar regions, even in the presence of large tumors, if the coils of intestine contain no air. If the diagnosis remains in doubt for any one of these reasons, percussion should be repeated after a few days and after the administration of a laxative. At the highest point of the abdomen abnormal conditions are less frequently encountered, except possibly when the intestines lie in front of the tumor or gas has developed in the tumor, as in the case of necrotic dermoid tumors. The characteristic sign of free ascites is the change in the line of tympany or dulness which accompanies a change in the position of the patient; since the freely movable fluid always goes to the dependent parts and the intestines tend to rise, the percussion note over the upper side of the abdomen becomes resonant when the patient is placed in the lateral position, while in the lower half the line of dulness extends higher up, but the boundary always forms a horizontal line. This sign is always present unless the ascites is not freely movable, or the intestines contain no air. The change in the line of dulness may also be determined by examining the patient first in the recumbent, and then in the erect position. Tumors usually do not alter their position at all, and the percussion boundary remains the same.

Special difficulties are encountered in the interpretation of the percutory signs in the case of myxoid tumors which have ruptured and discharged myxomatous fluid into the abdominal cavity, a complication which is quite frequent on account of the thinness of the walls of these tumors. In such cases we get the dulness of a large tumor situated in the median line and, in addition, dulness in one or both lumbar regions, which is due to the fluid accumulated in these localities. As, owing to its viscosity, the fluid does not seek a lower level with the change of position, the dulness is not movable. I have found the explanation for abdominal percutory findings in this condition in a great number of cases, and confusion with ascites is all the more apt to occur because the tumors are soft and cannot readily be palpated.

A very important sign of ascites is the difference observed in the percussion sound when superficial, and when deep percussion is made. With tumors of certain dimensions the note obtained will always be dull, irrespective of the force used in percussing, or whether deep or superficial percussion is employed, because the percussion wave cannot pass through the fluid; occasionally a slight admixture of intestinal tympany may be encountered at the margin

of the tumor. In ascites the note will be dull if light superficial percussion is used; whereas, if the pleximeter finger is pushed well into the abdomen, the ascitic fluid is pushed aside and intestinal tympany is obtained. In the case of freely movable ascites, this is probably the most reliable percutory sign, but I have known it to fail when the coils of intestine were deep in the abdomen and the mesentery was shrunken.

In suitable cases palpation may be the simplest method of making the differential diagnosis. Cysts with tense walls can sometimes be grasped in both hands and their boundaries easily determined, particularly in the lumbar regions; whereas freely movable ascites offers no resistance whatever to the palpating fingers and escapes in all directions. Occasionally a certain tenseness of the abdominal walls may be produced by the extreme distention of the abdomen which takes place in very high degrees of ascites; fluctuation is quite often a very reliable sign. It is elicited by applying one hand to the abdominal wall on one side, and gently tapping the opposite wall with the finger-tips of the other hand. In ascites a fluctuation wave is produced by the slightest impact of the fingers and sets up vibrations over the entire abdomen; the sign can never be elicited in the case of tumors with tense walls; only in thin-walled flabby cysts a wave may occasionally be produced. A kind of pseudofluctuation, due to agitation of the abdomen as a whole, sometimes occurs when the abdominal walls are very flabby. In suitable cases the differential diagnosis between ascites and cyst can be made by noting how far the fluctuation-wave extends into the region of the kidneys; if one hand is placed on the abdomen in that region, the wave in ascites may often be felt running as far as the vertebral column, while in tumors it comes to an end much sooner. If hard portions are felt in the periphery of an area which is distinctly resistant to palpation, they probably correspond to the parts of a tumor; whereas in ascites metastases are usually more diffuse, often much more movable, and generally confined to the region of the omentum. A distinct creaking leather sound, which is produced by a displacement of the colloid material within the tumor, is also regarded as a sign of a colloid tumor.

The differential diagnosis between ascites and cysts with very thin and flabby walls, is particularly difficult both in the case of parovarian or ovarian cysts with partly absorbed contents, and of cysts during the puerperium. In the first place, owing to the absence of internal pressure, the tumors in the recumbent position collapse and become so flat that the shape of the abdomen is the same as in ascites; or they sink to the deepest portion of the abdomen when the position of the patient is changed, so that a change of note is produced as in the case of ascites. Another difficulty is that the wall is

hard to palpate, and on tapping with the fingers a distinct fluctuation-wave is produced. Mistakes are very often made in differentiating between these two conditions.

If careful percussion and palpation are employed, and particularly if repeated examinations are resorted to, very few cases will be found in which the differential diagnosis between ascites and cysts cannot be made. In doubtful cases, exploratory puncture may be employed. After carefully disinfecting the abdominal walls, the sterilized point of an aspirator is introduced at a point on the abdomen where dulness has been positively demonstrated. If nothing is obtained through a moderately large canula, the condition is probably an ovarian tumor with colloidal contents; if fluid is obtained, a positive diagnosis may in some cases be made by examining the fluid. A thick, tenacious, colloidal consistency, with a brownish-green color and a high specific gravity of 1020 to 1040, is in favor of ovarian tumor; whereas in ascites the material is pale yellow, greenish, red or brown, from the admixture of blood, and the specific gravity between 1010 and 1015. As a rule ascitic fluid is very thin, but in the presence of gelatinous carcinoma it may have a thick, viscous consistency. Chemical and microscopical examinations rarely yield any positive results. The presence of pseudomucin, and frequently also of cholesterin, and epithelial, usually cylindrical cells, is in favor of ovarian cyst; while in ascites leucocytes and a large percentage of albumin should be present. If the contents of the tumor escape into the abdominal cavity, these signs are obscured. Exploratory puncture is now rarely employed by expert diagnosticians.

For the differential diagnosis between encapsulated ascites and ovarian tumors see page 307.

When ovarian tumors are complicated by the presence of ascites the diagnostic difficulties are increased, because percussion yields a combination of the percutory signs characteristic of both conditions; the intestinal tympany persists longest in a zone under the costal arch on both sides. The most reliable results are usually obtained by changing the patient's position, because the sound becomes resonant in the upper flank. If the tumor is larger than the ascitic collection, it is often impossible to demonstrate the presence of the latter; if fluid collects between the individual portions of the tumor and the abdominal wall, circumscribed areas with very distinct fluctuation are obtained. Extraordinary mobility—so-called dancing of the tumor—points to complication with ascites; on the other hand, if the mass of the ascitic fluid is greater than that of the tumors, the latter are much less conspicuous. Even under anesthesia it is often difficult to demonstrate a tumor and to

Complication of Ascites with Ovarian Tumors.

make out its outlines, consistency, and the pedicle connecting it with the uterus. The very important diagnosis of small papillomata or fibrosarcomata of the ovary is exceedingly difficult in the presence of a marked degree of ascites. If there is reason to suspect that such tumors are the cause of the ascites, the fluid should be drawn off through a puncture, when the tumors will be recognized with great ease in the completely emptied abdomen with its flabby abdominal walls. I do

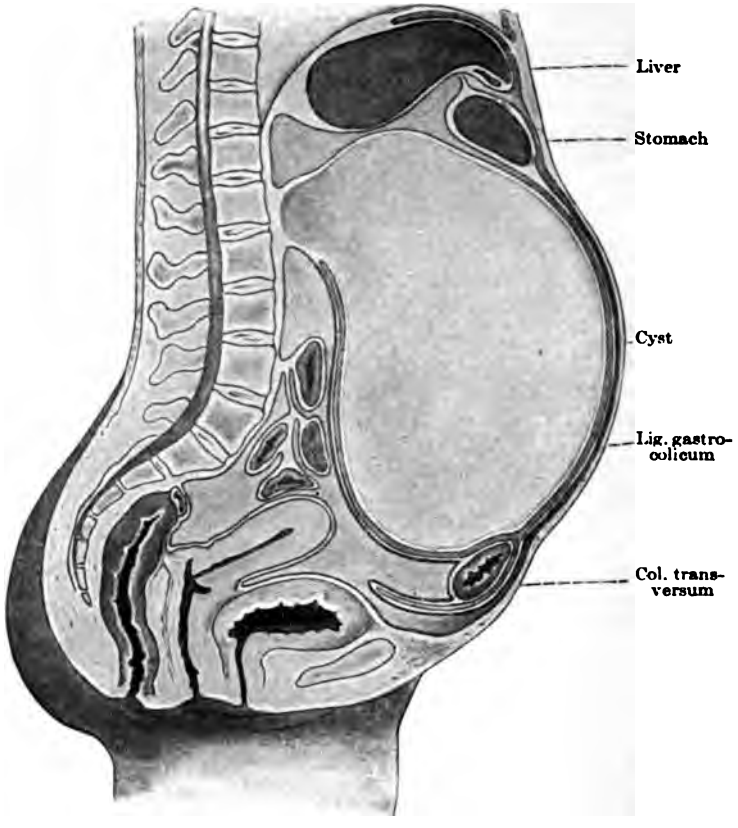


FIG. 160.— PANCREATIC CYST (after Sitzenfrey). The cyst lies between the colon and the stomach in contact with the abdominal wall, having caused extreme distention of the gastrocolic ligament.

not consider exploratory laparotomy permissible in cases of this kind unless there is reason to expect that there will be tumors to remove, because the danger of infection is greater in carcinomatous patients than under ordinary circumstances, and the patients are already so weak that they do not get on their feet again after the laparotomy.

In pancreatic cysts the seat of the tumor is the most characteristic feature. It develops under the left costal arch and grows from above downward; as the tumor increases in size the stomach and liver are displaced upward, while the gastrocolic ligament becomes

greatly stretched and the transverse colon is crowded downward. Only very large cysts extend as far as the genitalia. The consistency of the tumor is usually everywhere distinctly cystic. Pancreatic cyst may be mistaken for an ovarian tumor situated high up in the abdomen, or, on account of the diminished mobility, for an adherent ovarian tumor. The patient's statement that the cyst grew from above downward is against ovarian tumor, as is also the circumstance that the greatest prominence is always found at the umbilicus, in the neighborhood of the pancreas. The surest way to exclude ovarian tumor is by determining the boundary of the genital organs by bimanual examination. Exploratory puncture, which is recommended by some authors, and which is said to yield pancreatic ferments that can be definitely identified by chemical analysis, is not always reliable and may be dangerous on account of possible injury to the stomach, which is situated above the cyst.

Pancreatic Cysts.

FIG. 161.—PANCREATIC CYST. (After Flaischlen.)

Retroperitoneal and mesenteric tumors are often mistaken for ovarian tumors if they cause great distention of the abdomen and extend as far down as the pelvic inlet. Under these circumstances also the ovarian tumor could always be excluded without any difficulty if both ovaries were palpable and any connection between the tumor and the uterus could be excluded; but that is not always possible. The consistency is of no value either, because pure cysts may have their origin in retroperitoneal and mesenteric organs, and because retroperitoneal myxoma and sarcoma, owing to their softness, may simulate cysts.

The relations between the tumor and the intestine are characteristic in many cases. Whereas freely movable ovarian tumors push the intestines aside and are surrounded by tympany, retroperitoneal and mesenteric tumors often push the intestinal coils in front of them against the abdominal wall, and the note at the highest point of the tumor is tympanitic.

Splenic tumors may also be mistaken for ovarian cysts if they grow into the pelvic inlet, and particularly if they are the seat of cystic degeneration (echinococcus). If the latter is not the case, the peculiar parenchymatous consistency alone is indicative of a splenic

tumor, and it may further be recognized by its oblique position and the fact that it disappears under the costal arch. If a floating spleen is produced, the position of the tumor may, of course, be materially altered. For example, I once saw a large splenic tumor placed transversely across the pelvic inlet, leaving the splenic region proper entirely free. As a rule, notches are felt on the inner and upper margin of the splenic tumors extending several centimeters into the mass (Fig. 162). Echinococcus cysts of the spleen are large cystic tumors without the above splenic characteristics, but as a rule they also disappear under the left costal arch. It is almost needless to say that in this condition also an attempt should be made to find the ovaries by bimanual palpation and to exclude any connection between the tumor and the uterus. All splenic tumors are characterized by their position under the left costal arch, or at least by the fact that they can be replaced into that region.

Splenic Tumors.

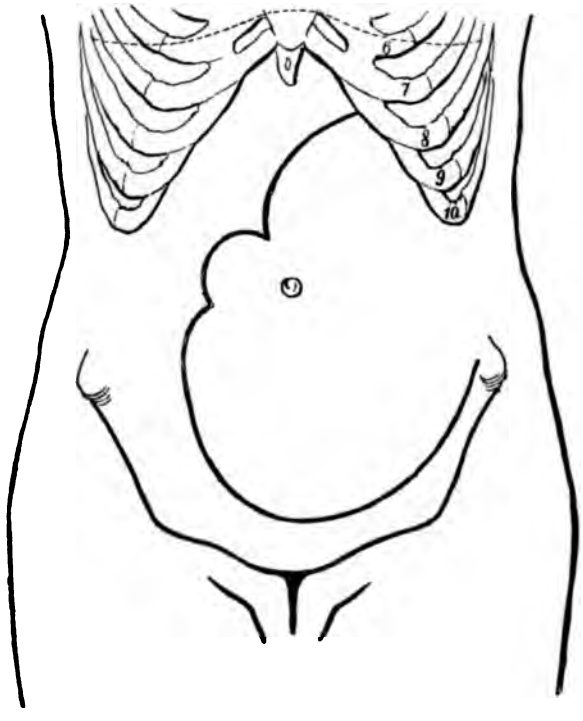


FIG. 162.—LARGE SPLENIC TUMOR SHOWING DISTINCT NOTCHES. P.-F. ½. (Original.)

Tumors of the liver are occasionally taken for ovarian tumors if they extend to the pelvic inlet; or they may be mistaken for ovarian tumors that have become fixed in the region of the liver by the formation of adhesions during pregnancy or the puerperium. Uniform enlargement of the liver is most easily recognized by the peculiar parenchymatous consistency, by the well defined lower hepatic border, and the characteristic direction of the tumor obliquely upward against the xiphoid process, as well as by the notch for the gall-bladder. In addition, all tumors of the liver are more or less distinctly movable with respiration. The mistake of diagnosing an ovarian tumor is most apt to be made in the case of enlargement of one lobe, separated from the liver by a constriction (Schnürleber); large hepatic tumors; and especially echinococcus cysts. Every effort should be made to

Tumors of the Liver.

establish a connection between the tumor and the genitalia or the liver. Often the character of the mobility is in itself distinctive, since pedunculated tumors of the liver are readily pushed upward and resist any attempt at downward displacement, whereas ovarian tumors move upward with difficulty but can easily be displaced downward. A positive diagnosis can be made only by finding a broad or cord-like connection with the liver or a pedunculated attachment to the uterus.

Ovarian tumors of medium and excessive size may, of course, also be confounded with subserous myomata, although the points of difference which have been explained in connection with the differential diagnosis of smaller tumors (see page 301) apply to this variety also. It should nevertheless be mentioned that cystic degeneration is more frequent in large myomata, and certain portions of the tumor may, therefore, greatly resemble an ovarian tumor; that, moreover, even in the case of multilocular cysts the consistency may be quite as firm as that of myoma. Nevertheless, the difference in consistency, as well as the connection with the uterus by means of a pedicle, is an important diagnostic point. The diagnosis of a large myoma may be rendered very much easier if the uterine cavity is elongated, although it must be remembered that in the presence of myomata the sound very frequently fails to reach the fundus, and the measurement obtained may therefore be deceptive. Large fibromata in the pelvic connective tissue are particularly apt to be mistaken for ovarian tumors, particularly if they have a thin pedicle and the consistency is soft. Interstitial soft myomata may also give rise to error if the junction between the cervix and the uterine body cannot be positively recognized and it is therefore impossible to demonstrate that the tumor is of uterine origin. If the junction of the folds of Douglas with the tumor can be definitely felt through the rectum, it is a decisive sign in favor of myoma (Sellheim).

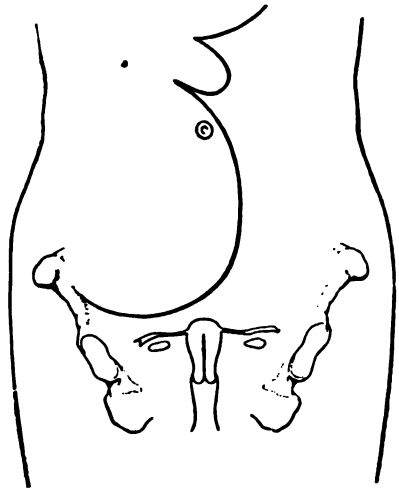


FIG. 163.—TUMOR OF THE RIGHT LOBE OF THE LIVER. P.-F. ⅓. (Original.) Above the tumor is the gall-bladder; the genitalia can be distinctly outlined.

Myomata.

Diagnosis of Certain Complications.

The clinical picture of a simple ovarian tumor is very much changed when complications develop. Such an occurrence is significant in various respects. In the first place, an originally benign cyst may undergo

malignant degeneration and destroy the patient's life; or the prognosis of an operation may be greatly influenced by the intraligamentary development of the tumor, or the presence of extensive adhesions, twisting of the pedicle, rupture of a large cyst; or suppuration of a tumor may convert a simple cyst into the cause of a serious and often fatal disease. Hence the physician must learn to recognize these complications, and he is in need of guidance for this puspose, as the above described diagnostic signs require emendation in several important respects.

Diagnosis of Intraligamentary Seat of the Tumor. The peculiar characteristics of this form are more pronounced when the tumor is entirely situated between the two layers of the broad ligament and grows toward the uterus. If, on the other hand, it is situated in the lateral portion of the broad ligament it may have the characteristics of a pedunculated tumor, the pedicle being formed by the free portion of the broad ligament, which becomes greatly distended. Parovarian cysts, in spite of the fact that they are often entirely intra-ligamentary, frequently possess a long-drawn-out pedicle of this kind, which permits a considerable degree of mobility and may even become twisted. Intraligamentary ovarian tumors all exhibit a certain degree of immobility because they are fixed to the pelvic floor by the investing layer of the broad ligament. Sometimes the immobility is only slight because the peritoneum is yielding. The degree of mobility is determined by attempting to move the tumor from above downward in bimanual palpation; the tumor will be found to be movable up to a certain limit, which is determined by the attachment of the infundibulo-pelvic ligament to the pelvic wall, but it can never be entirely pushed back out of the (false) pelvis. It is true that incarcerated and adherent tumors are also immovable. Incarceration is, of course, to be assumed only if the size of the tumor is greater than the width of the pelvis. In the case of adherent tumors the fixation is usually much more complete and can be directly felt to be due to adherent bands or exudates at the base of the tumor, while intraligamentary tumors are surrounded by soft, readily movable tissue. When the base of the tumor only is within

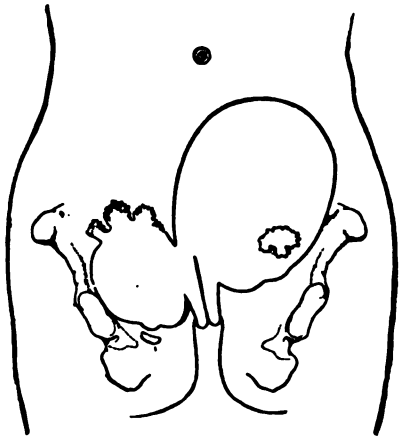
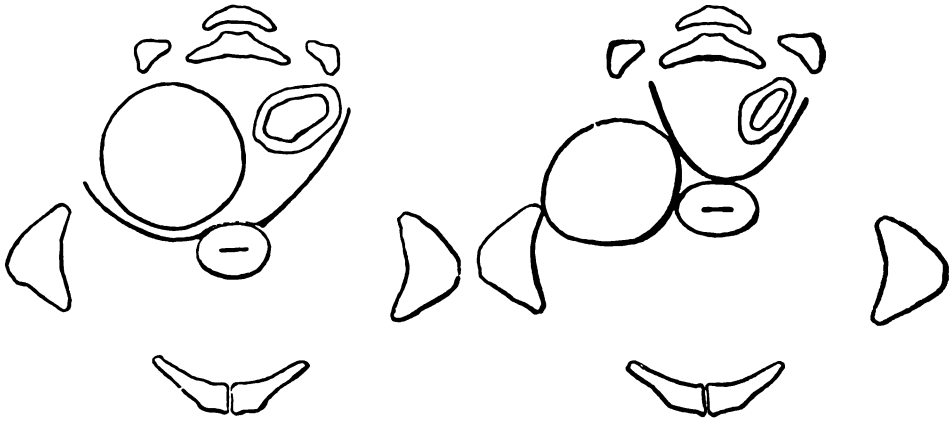


FIG. 164.—BILATERAL INTRALIGAMENTARY PAPILLARY OVARIAN TUMOR. P.-F. ⅛. (Original.) The tumor on the right side is situated deep within the true parametrium, that on the left, above, in the broad ligament. Both are so united with the uterus that the fundus cannot be outlined; only the cervix and a piece of the body are palpable. Sound, 7 cm. Both tumors exhibit papillary excrescences ('trees').

Diagnosis of Intraligamentary seat of the Tumor.

the broad ligament it often forms a fixed point around which the dome of the tumor can be moved. The relation of the tumor to the uterus is very important for determining whether it is intraligamentary; but great differences of course exist in this respect also, depending on the proximity of the tumor to the uterus. In many cases it lies so close to the organ that the two are only separated by a shallow constriction, or the fundus only can barely be differentiated. The uterus may be attenuated and drawn out lengthwise by the close apposition of the tumor, to such an extent that its presence can only be demonstrated with a sound; or the tumor may encroach on the uterine muscle so that it seems to originate in the uterine wall. In other cases again, when the broad ligament is not entirely unfolded, and there is a considerable interval between the uterus and the tumor, it is not possible to demonstrate the connection between the two, and both masses can easily be moved one against the other. The characteristic sign in all cases of this kind is that the tumor is actually connected with the lateral aspect of the uterus. Even this sign is less distinct if the median portion of the broad ligament is free, as in that case the uterus may be displaced so far forward or backward that the tumor appears to be either in front of or behind the organ; but by bringing the two together the connection between them can be plainly demonstrated. The anterior surface of the uterus usually forms a continuous contour with the anterior surface of the tumor covered with broad ligament, while the posterior layer is greatly displaced upward by the growth of the tumor. The latter then takes up its position at the posterior surface of the uterus, where it is not covered with peritoneum, and gives the impression of a retro-uterine tumor. Separation with upward displacement of the anterior layer is much more rare, although it is occasionally observed, particularly in the case of papillary tumors which grow around the bladder into the preperitoneal excavation of Retzius. Occasionally an intraligamentary tumor grows far down into the pelvis if it penetrates into the base of the pelvis—the true parametrium. Such tumors are deeply placed on the floor of the pelvis and have a situation similar to that of pedunculated tumors lying deep down in Douglas' space. If they are situated more in the true broad ligament they project far above the pelvic inlet. Displacement of the uterus, especially if the displacement is exactly to one side, is a conspicuous sign of intraligamentary tumor. Retro-uterine or laterally situated pedunculated tumors which are prevented from growing upward by incarceration or by adhesions also displace the uterus in order to gain room for their growth, but the displacement is usually only to one side and forward. Bilateral intraligamentary tumors often force the uterus completely out of the pelvis; occasionally one tumor is found high up, and the other low

down alongside of the uterus. Palpation of the adnexa may also assist in determining the seat of an intraligamentary tumor if the long-drawn-out tube is found in close apposition with the tumor and the round ligament passes obliquely over the anterior surface to the internal ring. A sign which is absolutely reliable in the differential diagnosis between an intraligamentary tumor and one situated deep down in Douglas' space is the direction of the folds of Douglas; but, unfortunately, they cannot always be felt. If the fold is felt in front of the tumor, the latter occupies Douglas' space (Fig. 165); whereas in the case of intraligamentary tumors the fold is pushed backward and toward the median line (Fig. 166). Large intraperitoneal cysts cause stretching of the corresponding fold of Douglas so that the intermediate portion escapes palpation, while the two extremities are distinctly felt



FIGS. 165 AND 166.—BEHAVIOR OF THE FOLDS OF DOUGLAS WITH RETRO-UTERINE AND WITH INTRALIGAMENTARY OVARIAN TUMORS. 1/3. (Diagrammatic.) (Original.)

and the fold as a whole can be pulled away from the tumor. In the case of intraligamentary tumors growing in close apposition with Douglas' fold, the latter is often completely flattened so that it can not be picked up (Sellheim).

Diagnosis of Adhesions.

The **diagnosis of adhesions** presents few difficulties if the tumor occupies the pelvis. Their presence is at once indicated by the fact that the tumor cannot be replaced, unless this is due to incarceration or to an intraligamentary position of the growth; as a rule, the short bands of adhesions, which are very sensitive to pressure, are felt at the base. If the tumor occupies the false pelvis, it must be determined whether parietal adhesions are present. These are most easily recognized by immobility of the tumor. Whereas a tumor, unless it be very large, can easily be moved from right to left and, if the position of the pedicle does not interfere, from above downward, the mobility is entirely abolished in the presence of diffuse parietal

adhesions and the tumor lies in close contact with the abdominal walls. It is true that great tension of the abdominal walls may occasionally interfere with the mobility of a large tumor to such a degree that it appears to be adherent. Partial adhesion to the anterior abdominal walls is often recognized by forcibly displacing the tumor, as this is accompanied by retraction of the abdominal wall at the corresponding point. Local pain on pressure or a peritonitic friction-sound suggests adhesions from recent peritonitis. Intestinal adhesions may be suspected if the tumor is broadly adherent to the anterior abdominal wall; their presence is assured only if a soft, ribbon-like resistance is commonly felt in certain definite regions, and gurgling noises are elicited in the supposed situation of the adhesions. Adhesions with the omentum, the liver, and the spleen cannot as a rule be recognized with certainty.

The **diagnosis of torsion** can be made by directly palpating the twisted pedicle only in exceptional cases. Sometimes the pedicle appears to be unusually thick and short, or constriction can be felt on the surface, or, as in especially favorable cases, it may be possible to feel individual twists. As a rule, twisting of the pedicle is recognized only by its consequences; in very rare cases there is complete absence of all symptoms, and the operator is surprised to find a twisted pedicle. In some cases the only symptom is pain, which rapidly increases and subsides again, particularly at the menstrual period; but the most important sign of torsion is found in sudden attacks of acute pain often following a slight traumatism (raising the patient, turning over in bed), and associated with nausea and vomiting. The pain disappears in a short time, to recur repeatedly if new adhesions are formed after the attack. Usually, but not always, general peritonitis develops with moderate fever, rapid pulse, and meteorism; during the acute stage the tumor cannot be distinctly felt on account of the great meteorism. When the abdomen collapses, the outlines of the tumor gradually stand out and become more and more distinct as the inflammation subsides. If a peritonitis develops before the presence of a tumor has been suspected, the diagnosis may remain in doubt for a long time; on the other hand, if diffuse inflammation develops in a case in which ovarian tumor has been positively demonstrated, the most frequent cause is torsion of the pedicle. The condition may be suspected in the presence of general adhesions with the intestines, the abdominal walls and the uterus, which have resulted from a diffuse peritonitis. Torsion is most frequent in the case of medium-sized tumors.

Diagnosis of Torsion of the Pedicle.

Rupture of an ovarian tumor is a not infrequent accident, particularly in the case of thin-walled, myxomatous cystadenomata. The

signs of rupture are produced by the escape of fluid into the abdominal cavity and vary according as the fluid escapes slowly or rapidly in large masses, and according as the contents are serous, colloidal, myxomatous, or purulent. The escape of small quantities of serous or myxomatous material hardly makes any impression; the escape of larger masses is usually the cause of sudden and violent pain, often accompanied by vomiting and followed by symptoms of peritonitis, moderate in degree, as in the case of torsion, and without the character of septic phenomena. Sudden death sometimes follows rupture of an ovarian tumor before a peritonitis can develop. The escape of purulent contents may lead to a rapidly fatal septic peritonitis. Large myxomatous masses remain in the abdominal cavity because they cannot be absorbed and form a thick envelope around all the abdominal organs. As a rule, the condition is not attended by any clinical symptoms or inflammatory reaction. The development of peritoneal symptoms is accompanied by objective changes in the tumor, which either disappears altogether or is much reduced in size and collapsed.

Rupture of an Ovarian Tumor.

Suppuration of an ovarian tumor, most frequently from infection with streptococci, typhus bacilli or bacterium coli, may be suspected if the patient has been exposed to an infection (puerperium, typhoid fever), and a protracted febrile condition develops, with increasing loss of strength for which no other cause can be found. The tumor is not necessarily painful, either spontaneously or on pressure, so long as the serous coat is not infected. If symptoms of peritoneal reaction develop, the mystery is solved, and the long-sought-for cause of the fever is found. The fever is accompanied by a high degree of leucocytosis.

Suppuration of an Ovarian Tumor.

Pregnancy, which as a rule occurs only with small or medium-sized tumors, endangers the woman's life in a variety of ways through mechanical interference with parturition, rupture and torsion of the pedicle, and suppuration during the puerperium. It is, therefore, important to recognize the occurrence of pregnancy, because it usually requires immediate removal of the tumor. During the early months the diagnosis may be difficult if the tumor interferes with palpation of the uterus; if the tumor and the uterus are of approximately the same size and occupy the abdomen, the suspicion of bilateral tumor may be at first entertained, until the characteristic properties of one of the tumors and its junction with the vaginal portion identify it as a gravid uterus. The recognition of a tumor alongside of a large gravid uterus during the later months may be difficult if the tumor, which usually rises with the uterus, sinks into the lumbar region where it cannot be palpated; or, on the other hand, if the tumor lies close to

Pregnancy.

the uterus. Under these circumstances the points to be especially noted are: the distinctly cystic consistency of the ovarian tumor and the thickness of the wall. An attempt must be made also to demonstrate a division between the two masses, even if it is no more than a distinct furrow; if the uterus and the cyst become so large that there is not room for both in the abdominal cavity, delimitation may be very difficult, as shown by the following case.

Case 27. Mrs. H. presents herself on the 19th of January, 1894, on account of a great increase in the size of the abdomen; circumference at the navel, 122 cm. A large tumor fills the entire abdomen, dull on percussion; intestinal tympany is elicited in both lumbar regions; massive fluctuation over the entire tumor. The vaginal portion appears somewhat soft, and its junction with the tumor is to the right of the median line; in the right anterior vaginal vault a fetal head is indistinctly felt; to the right above, under the arch of the ribs, another large fetal part. I was, therefore, compelled to assume a pregnancy, although the distinct fluctuation, the thin walls of the tumor, and the distinct palpation of fetal parts on the right side did not tally with the diagnosis of hydramnion. As the combination of ovarian tumor and pregnancy did not seem to me probable because it was impossible to demonstrate any furrow or division between the pregnant uterus and the tumor, I considered a twin pregnancy with a single hydramnion as the most likely explanation, in spite of the fact that the uterine wall on the left side appeared to be too thin. The last menstruation had occurred at the end of May, 1893; on the first of March, the woman was delivered spontaneously and, after the birth of the child, a large, flabby, thin-walled tumor remained behind. The uterus had been embedded in the right wall of the tumor, in which it had formed a deep depression, so that the two represented a single tumor. At the operation, which was performed later, a parovarian tumor was found.

Small tumors occupying the true pelvis are not easily recognized as ovarian tumors because the tension of the tumor wall is so great that they are mistaken for myomata, particularly as, owing to their close apposition to the uterus, it is difficult to make out a separation, or to palpate the pedicle; quite often a positive diagnosis can be made only under chloroform anesthesia. Diagnostic errors, which are not rare, usually consist in overlooking pregnancy during the early months, and the tumor during the later months of gestation.

The **diagnosis of malignancy** is of vital importance because it necessitates immediate removal of the tumor. In certain respects the tumors themselves may arouse a suspicion of malignancy by certain easily recognized peculiarities, for which the reader is referred to the description of the palpatory peculiarities of carcinoma, sarcoma, endothelioma and teratoma in another part of the book. In addition, we have a number of other peculiarities and deviations from the clinical pictures of a simple tumor which, when taken together with the palpatory findings, usually make a positive diagnosis of malignancy possible. For instance, malignancy may be suspected in the case of bilateral tumors of approximately equal size, and when a tumor develops partially within the broad ligament. Ascites is regularly found with malignant tumors and is therefore always suspicious; but it is not a positive sign of malignancy. Moderate quantities of

Diagnosis of Malignancy.

ascitic fluid are found with glandular cysts, and ascites in large quantities may be present with fibromata and fibrosarcomata, and particularly with papillomata as soon as the papillæ reach the surface. The age is of little value in the diagnosis of malignancy. Malignant tumors may occur in young individuals and, on the other hand, advanced age is not incompatible with the presence of benign tumors. Marasmus and cachexia are also possible accompaniments of large benign tumors; but if the tumor is small, they are suspicious factors. Edema of the legs developing early in the presence of a small tumor I regard as one of the most positive signs of malignancy. It follows, therefore, that the diagnosis is not absolutely certain so long as the carcinoma is confined to the tumor; it becomes positive only when the malignant process has spread to the surrounding structures, as malignant tumors form a broad and massive attachment to their surroundings and become absolutely and immovably fixed. By dissemination of the carcinoma metastases are formed on the floor of Douglas' space and on the pelvic peritoneum, appearing either as solitary nodules or as coherent brawny masses. In combined examination through the rectum and vagina these nodules can usually be separated from the main tumor, and by moving the hands up and down a rubbing, crunching sound—so-called 'snowball crunching'—is produced. Similar sensations are felt in the presence of hemorrhages in Douglas' space, tuberculous nodules on the peritoneum, and papillary excrescences on the surface of ovarian tumors, and the distinction from carcinomatous metastases is made by the fact that in the latter case the crunching sound is much coarser and more intense. From the hilus of the ovary carcinomatous masses make their way into the pedicle, and hence into the broad ligament and parametrium, where they produce solitary nodules, or more frequently a coherent, cartilaginous thickening. In this way the base of the tumor becomes surrounded by irregular nodular masses. If nodular tumors are found in the upper portions of the abdomen, especially in the region of the omentum and transverse colon, they are to be regarded as metastases and indicate malignancy; they must not, however, be mistaken for scybalous masses or a crumpled, contracted omentum, such as we find in tuberculous peritonitis. In many cases the true nature of the tumor will be revealed only by inspection at the operation. As ovarian carcinoma is usually metastatic, a search should be made for a primary carcinoma in the abdomen, which is usually found in the stomach or in the intestine.

Diagnosis of the Variety of the Ovarian Tumor.

After the diagnosis of ovarian tumor has been definitely established, the physician, whether he be a general practitioner or a specialist, should try to determine to what variety the neoplasm belongs, as both

prognosis and treatment depend on the decision of this question. In the main it may be said that this is not difficult in the majority of tumors. In a few cases, however, even the specialist will be unable to make the diagnosis clinically, and the classification of the tumor must be left to the pathologist. The following points are available in making the diagnosis.

Follicular Cysts.

1. Follicular cysts, as a rule, are of about the size of a fist; they are usually unilocular, have thin, moderately tense walls, and the contents are pale and serous; the cysts are usually unilateral, show little tendency to form adhesions and, if favorably situated, rarely produce symptoms (Fig. 167).

A subvariety of follicular cyst is found in certain cystic tumors of the ovaries which develop on an inflammatory foundation. These 'inflammatory cysts' result from retention in one or several follicles, occurring with inflammatory processes in the adnexa, and are therefore found associated with tubal diseases, adherent peritoneal cysts, and parametritic conditions of various kinds. They are usually bilateral and adherent to adjoining structures, and the contents are serous. If a communication is established between an inflammatory cyst and a coincident hydrosalpinx, there results a tubo-ovarian cyst, a combination of a moderately large ovarian cyst with a dilated tube, the abdominal extremity of which usually forms the connection with the ovary.

Fig. 167.—Follicular Cyst of the Ovary. (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg.) ⅓. (Original.) To the right of the cyst, some remains of ovarian tissue.

These inflammatory cysts can be recognized clinically by the symptoms of inflammation, the irregular shape of the tumor, and the many adhesions with surrounding structures. Tubo-ovarian cysts, which rarely exceed the head of a child in size, can sometimes be recognized by their peculiar shape—like that of a retort—which is produced by the reflection of the dilated tube in the spheroidal ovarian portion of the tumor (Fig. 168).

2. Corpus luteum cysts, which are usually not larger than the fist, have thick walls but otherwise are not characterized by any special peculiarities (Fig. 169).

3. Simple serous cysts (cystoma serosum simplex) are unilocular, thin-walled tumors, or, rarely, made up of two or three cavities placed side by side. The contents are fluid; clinically they differ very little from follicular cysts except that they attain a much larger size.

4. Proliferating glandular cyst (cystadenoma pseudomucinosum) is the commonest clinical variety of ovarian tumor, and may be of any size. In the simplest cases it is approximately spherical, and this shape is retained when a large cyst predominates in the tumor; the shape becomes irregular by the development of several cysts on the

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FIG. 167.—FOLLICULAR CYST OF THE OVARY. (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg.) ½. (Original.) To the right of the cyst, some remains of ovarian tissue.

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outer surface of the main tumor, in which case numerous constrictions and divisions are found. When the tumor consists chiefly of one large cyst, the surface is smooth; but when several cysts project from the tumor it becomes nodular. The consistency of the tumor depends on the size of the cysts; small tumors usually have a solid feel; large tumors are distinctly cystic and present separate areas of fluctuation when there are several larger cysts, or continuous fluctuation when the tumor consists of a single large cavity. Multilocular cysts with small cavities are sometimes absolutely hard and without fluctuation anywhere. In most large,

Cystoma Glandulare Proliferans.

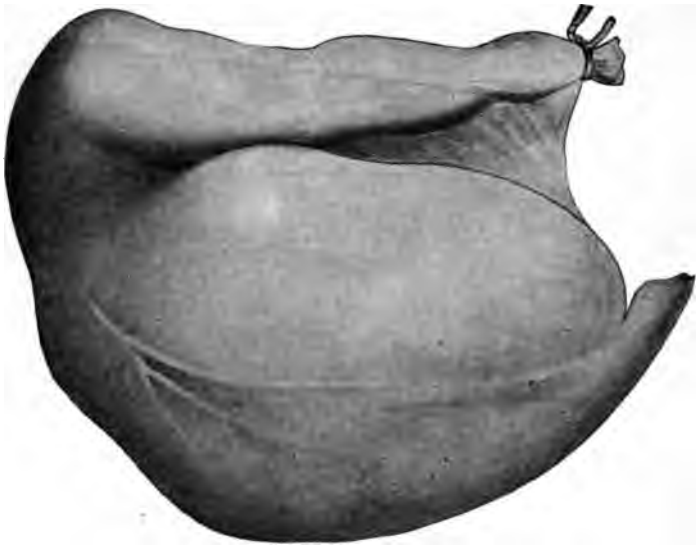

FIG. 168.—TUBO-OVARIAN CYST (after Martin).

distinctly cystic tumors hard areas are found in the wall which correspond to parts that have not yet undergone cystic degeneration. The mobility in the case of pedunculated ovarian tumors is quite great, unless it is interfered with by tension of the abdominal walls or by adhesions. Large tumors usually form adhesions, most frequently with the omentum, intestines, or abdominal wall; rarely with the uterus and pelvic organs. Cystadenomata are often unilateral and usually pedunculated; ascites is rare and when it is present, the quantity of fluid is small (Fig. 170).

5. Proliferating papillary cystoma (cystadenoma serosum, papillary cystoma—Pfannenstiel) rarely exceeds the size of a man's head. Most of the tumors are about as large as a child's head; the shape is rarely absolutely round, the surface is nodular or bosselated, and often covered with distinctly palpable papillary excrescences.

Quite often the consistency is not recognized as cystic because the cavities are small and filled with papillary masses. In the great majority of cases these tumors are bilateral, or at least one of the tumors is generally intraligamentary; but they are rarely entirely within the broad ligament. As a rule the base only is intraligamentary, while the periphery is free. Adhesions with adjacent organs and with the pelvic peritoneum are very frequent; hence absolute mobility is rare. Peritoneal metastases are very often found in advanced cases, particularly in Douglas' space. Ascites occurs early, especially when the surface is covered with papillæ; the quantity of fluid is usually abundant. Superficial papilloma represents a distinct papillary tree on a normal ovary; it is usually bilateral and early causes ascites (Fig. 171).

Cystoma Papillare Proliferans.

Fig. 169.—Corpus Luteum Cyst (after Martin).

6. Primary carcinomata in the main have the same shape as the ovary; if they increase in size, the surface becomes irregular from protruding nodes and cysts. Small tumors are hard; larger tumors are cystic in places because softening processes not infrequently take place in the interior of the tumor (Fig. 172). The pedicle is usually short, and often inserts in a hilus of the tumor. (For other clinical peculiarities see page 327). If a carcinoma develops secondarily in a cystadenoma, the characteristics of the latter remain unchanged so long as the carcinoma is confined to the interior of the tumor.

7. Dermoid tumors rarely exceed in size a man's head; most frequently they range between the size of a hen's egg and that of a child's head; they are approximately round or oval, and frequently have the shape of a biscuit with a suggestion of a division. The contents consist of fluid, fat, hair and teeth, growing out of the epidermoid inner wall; the wall of the tumor not rarely contains pieces of bone, which can be plainly felt if the tumor is in a favorable situation. Dermoid cysts of moderate size often give the impression of a hard, solid tumor because the wall is usually thick and

Dermoid.

tense; the cysts are often characterized by great sensitiveness on pressure, and occasionally give rise to spontaneous pain. They grow

FIG. 170.—CYSTADENOMA PSEUDOMUCINOSUM. ½. (Original.) (Preparation from the Kgl. Universitäts-Frauenklinik in Königsberg.) In some of the cysts the contents are coagulated; others are empty; small papillæ develop in a few of the cysts.

very slowly and are most frequently observed in young persons. They are rarely bilateral. Dermoid tumors often become adherent

FIG. 171.—CYSTADENOMA SEROSUM (after Gebhard). (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.)

to adjacent organs and are exposed to infection from the intestine; as a result gas is generated within the tumor and perforation into neighboring organs takes place (Fig. 173).

8. Teratomata are composed of various embryonal organs derived from the three germinal layers. They represent tumors exceeding in size a man's head, are often observed in youthful individuals, and grow rapidly. The consistency is firm, often hard; the bone, which is a frequent constituent of the tumor, may be exceedingly hard; the surface is smooth and sometimes nodular; the tumors are usually connected with the uterus by a pedicle. If the tumor is malignant, which is not always the case, ascites and metastases develop. A clinical diagnosis is rarely possible; if abundant masses of bone are present it may be possible with the aid of radiography. Teratoma.

9. Ovarian fibromata are approximately round or oval, very hard, with a smooth, slightly lobulated surface, and generally unilateral. They may be larger than a man's head, early lead to ascites, and frequently contain cysts in their interior (Fig. 174).

Fig. 172.—Primary Ovarian Carcinoma (in cross-section). ½. (Original.) (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg.) Large portions of the carcinomatous tissue have been destroyed by hemorrhages.

10. Sarcoma occurs in two distinct clinical and pathological forms:

Fibrosarcoma (spindle-cell sarcoma) may be twice as large as a man's head, lobulated and hard. The tumors are usually bilateral and produce ascites, benign, do not lead to metastasis, and do not recur (Fig. 175).

Round-cell sarcomata are soft, medullary tumors with a fairly smooth surface; they are usually unilateral, and often give rise to ascites. They sometimes attain a considerable size. The neoplasm early breaks through the surface and causes infection of adjacent structures, especially the abdominal cavity.

11. Perithelioma and endothelioma have the same properties as round-cell sarcoma.

In connection with the foregoing, I shall discuss at this point:

The Diagnosis of Acute and Chronic Oophoritis.

A positive diagnosis of acute oophoritis can be made only when the ovary can be isolated by palpation. The most important alteration consists in swelling of the organ, which rarely exceeds in size that of a hen's egg or a goose egg (see Case 23). Depending on the degree of alteration, the consistency of the ovary becomes soft and compressible, or even fluctuating if an abscess is present; a certain degree of sensitiveness is rarely absent. The constitutional symptoms, spontaneous pain and onset with fever, Acute Oophoritis.

which constitute the symptoms of acute oophoritis, are of value in the differential diagnosis from small cysts. The diagnosis is more difficult when acute oophoritis develops after a tubal disease, or when it accompanies an acute perioophoritis. As it is difficult in these cases to palpate the ovary separately, and the sensitiveness cannot be referred to the ovary alone, the most important symptoms are absent; nevertheless, involvement of the ovary may be assumed if the adnexal disease consists chiefly of a large and approximately round tumor. The cause is gonorrheal, septic, or tuberculous infection. Until pus can be

FIG. 173.—DERMOID CYST OF THE OVARY (after Pfannenstiel). In the centre of the tumor is the hirsute, dermoid core; to the left, the 'anlage' with two prominent dental sacs, and around them a few spicules of bone.

obtained, the diagnosis of gonorrhea depends on the clinical and pathologic demonstration of uterine gonorrhea. Tuberculosis may be assumed if other foci of the disease are found in other parts of the body. Septic infection (chiefly streptococcal) is indicated first of all by the existing possibility of infection (puerperium, operation, local uterine manipulations), and by continued febrile movements, particularly when associated with menstruation.

The frequency with which the diagnosis of chronic oophoritis is made by physicians is greatly in excess of the actual frequency of this disease. Even more than in acute oophoritis, it is absolutely necessary to isolate the diseased ovary by palpation, and a diagnosis of oophoritis based solely on the fact that pain is produced by external

pressure in the ovarian region must be rejected. If the ovary can be palpated by itself, if involvement of the peritoneum can be positively excluded, if there are no exudates or adhesions, the diagnosis is based in the main on two factors: enlargement and sensitiveness of the ovary; but these factors must both be present to establish the diagnosis. Enlargement of the ovary occurs by thickening of the stroma, or dilatation of the follicles, or both, and affects all parts of the organ uniformly. The ovary is usually as large as a pigeon's egg, rarely attaining the size of a hen's egg. The enlargement is constant in chronic oophoritis, in contradistinction to the temporary enlargements which are produced in the normal ovary by the formation of follicles and corpus luteum. The consistency is hard, often tense, but in no sense characteristic; as the same process is observed in small dermoid cysts, whereas small retention-cysts are more distinctly fluctuating. The surface is occasionally nodular or mamillated from the presence of small cystic degeneration follicles; hence enlargement and consistency alone are not sufficient for a diagnosis; they must be associated with another symptom—pain on pressure. But the value of a subjective symptom like pain on pressure is very uncertain on account of the individual differences in sensitiveness, as well as the differences in the degree of pressure used at the examination. It must also be remembered that normal ovaries may be somewhat painful, and that perimetritic and parametritic processes may simulate ovarian pain on pressure or sensitiveness. Severe pain distinctly localized in the ovary

Fig. 174.—Ovarian Fibroma (after Gebhard). (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.)

Fig. 175.—Fibrosarcoma of the Ovary. ½ (Original.) (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg.)

is a valuable symptom, but by itself it also is insufficient because nervous sensitiveness, so-called ovarism, neuralgia of the ovary, is not a rare condition. It follows, therefore, that the combination of distinct sensitiveness with constant enlargement of the ovary must be regarded as the most positive sign of chronic oophoritis.

The diagnostic difficulties are considerably increased when chronic oophoritis occurs in connection with tubal diseases, perioophoritis, and parametritic exudates. The sensitiveness in these cases must never be attributed to the ovary alone and, as the gland cannot be palpated separately, it is not possible to recognize any existing enlargement. In most cases of chronic adnexal tumors it is safe to assume the existence of inflammatory processes in the ovary also.

The symptoms are so indefinite or so general that they are of no value for the diagnosis of chronic oophoritis. Radiation of the pain into the thighs is more frequently observed than in other inflammatory processes.

Diagnosis of Malignant Diseases of the Uterus.

I. Carcinoma of the Uterus.

Classification. Carcinoma of the uterus develops in the mucous membrane, or immediately underneath the membrane from its elements. The mucous membrane is therefore properly taken as the starting-point for the classification, and, in agreement with Ruge and Veit, we distinguish the following varieties:

1. Carcinoma of the vaginal portion. This originates in the mucous membrane which covers the vaginal portion, *i.e.*, from the external os to the insertion of the vaginal vault (Fig. 176, red).

2. Carcinoma of the cervix, originating on the mucous membrane between the external and the internal os (Fig. 176, transverse shading).

3. Carcinoma of the body, originating in the uterine mucous membrane from the internal os to the tubal orifices (Fig. 176, blue).

Fig. 176.—Normal Uterus, Showing the Different Segments of the Mucous Membrane. (Schematic.) (Original.)

This classification is justified not only by the differences in the histologic pictures of carcinomata, which correspond to the structure and character of the several segments and the mucous membrane from which they originate; but also by the differences in the clinical findings and the lines of extension followed by the individual forms. It is obvious, of course, that the division, especially that of carcinoma of the vaginal portion and of the cervix, can only be carried out during the early stages. The classification of carcinomata is important because not only the clinical picture of cancer, but the methods of diagnosis also are entirely different, depending on the starting-point and extension of the carcinoma.

The diagnosis of uterine cancer is based on the objective demonstration of the changes produced by the neoplasm at the point of origin and in the immediate neighborhood; hence before discussing diagnostic methods, I shall give a fuller description of these alterations.

Clinical Pictures and Lines of Extension of Cancer of the Uterus.

1. Carcinoma of the Vaginal Portion. The carcinoma represents a neoplasm which more or less rapidly undergoes degeneration. The neoplasm may grow from the vaginal portion into the lumen of the

vagina and appear as a tumor projecting from that canal; or it may grow into the tissue of the vaginal portion and produce infiltration. Depending on whether the neoplasm degenerates rapidly or slowly, infiltration or ulceration will predominate. In this manner various clinical pictures are produced, a sharp differentiation of which is important in a diagnostic sense, although it must be admitted that they merely represent different stages of the same variety developing side by side, not different forms of carcinoma. We distinguish:

Fig. 177.—Cauliflower Cancer of the Vaginal Portion, Amputated above the Vagina. (From a preparation in the Kgl. Universitäts-Frauenklinik in Berlin.) ½. (Original.)

1. Polypoid carcinoma of the vaginal portion. This so-called cauliflower carcinoma represents a tumor of the vaginal portion, originating either in both lips, or in only one lip, or only part of one lip, and quite frequently in the commissure. The tumor may be broadly sessile and attached to the entire width of the vaginal portion, or merely to the periphery, forming a pedunculated tumor; the pedicle is rarely smaller than one finger; the size is quite variable, from that of a hazelnut to that of the fist, in the latter case filling the entire lumen of the vagina. The parts of the vaginal portion not affected by the carcinoma are hidden behind the cauliflower and often difficult to find; the surface of the tumor is never smooth; usually nodular, uneven, rough, and friable (mortarlike). In rare cases the surface is red; but usually it is covered with a greasy, gangrenous mass (Figs. 177 and 178).

Fig. 178.—Pedunculated Cauliflower Cancer of the Vaginal Portion. (From a specimen in the Kgl. Universitäts-Frauenklinik in Berlin.) ½.

2. Infiltrating carcinoma produces thickening and hardening of the tissues of the vaginal portion, forming a ring around the entire structure, or leaving one lip or part of one lip free; the depth to which the infiltration extends into the tissue is variable, but rarely goes beyond the insertion of the vaginal vault. The surface shows small, insignificant ulcers; in rare cases the mucous membrane may be quite intact (Fig. 179).

3. A carcinomatous cavity in the vaginal portion is a funnel-shaped cavity produced by ulceration, usually corresponding to one lip, and involving the tissue of the vaginal portion almost to the interior os. The cavity runs parallel to the cervical canal and external os, and often ascends along with the lower portion of the cervical canal (Fig. 180).

4. Carcinomatous ulcer is a flat ulceration on the surface of the vaginal portion, showing no tendency to extend downward into the tissues and spreading only on the surface; it is usually limited to one lip of the cervix (ulcus rodens) (Fig. 181).

FIG. 179.—INFILTRATING CARCINOMA OF THE VAGINAL PORTION. ⅓. (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.)

Lines of extension. Pure carcinoma of the vaginal portion regularly extends along the surface toward the vaginal vault, and from there to the walls of the vagina, extension to the cervical mucous membrane being rarely observed. Cauliflower cancers and carcinomatous ulcers have the greatest tendency to spread to the vagina, and chiefly attack the surface of the vaginal wall which adjoins the diseased lip. Carcinomata which penetrate the substance of the vaginal portion are more inclined to spread in the submucous tissue of the vagina, and lead to infiltration, which at first is covered with mucous membrane, in the form of a circular infiltration; they advance slowly toward the introitus and are always deepest in the anterior, and highest in the posterior wall. Occasionally metastatic nodules appear underneath the mucous membrane, their favorite seat being the posterior wall of the fold surrounding the urinary meatus. In rare cases so-called contact cancers, *i.e.*, carcinomatous changes in those parts of the vaginal wall which are in contact with the primary cancer, are encountered. Extension to the cervical tissue is most frequently seen in the infiltrating forms. The extension is continuous, or, in extremely rare instances, discontinuous by leaps, and goes on to a variable distance, rarely as far as the internal os, and only in extreme cases beyond that point. Occasionally the cervical mucous membrane becomes infected from behind. The body of the uterus is attacked only in the very last stages, and then only by continuous

FIG. 180.—CARCINOMATOUS CAVITY IN THE VAGINAL PORTION. (From a specimen in the Kgl. Universitäts-Frauenklinik in Berlin.) ½. (Original.)

Lines of Extension.

growth of the cancer. Discontinuous spreading in the form of metastases very rarely occurs in the tissues of the body and has as yet never been observed in the mucous membrane. According to Seelig, early involvement of the body by way of the lymph vessels is probable. The pelvic connective tissue is reached by way of the vagina, or the periphery of the lowest segment of the supravaginal portion. The extension of the carcinoma in the lymph clefts in the pelvic connective tissue is determined by the architecture of the parametrium; it takes place most frequently in the posterior segments of the lateral parametrium, which are situated laterally and in front of Douglas' folds, and goes as far as the pelvis. The anterior segment of the parametrium and the portion on each side of the bladder almost always escape. The thick layer of the parametrium between the cervix and the bladder, and posteriorly between the cervix and the peritoneum, afford little room for the spread of the cancer. Infection of the pelvic connective tissue usually takes place by continuity in the form of an infiltration which is continuous with the diseased parts of the portio vaginalis or of the vaginal vault; as the result of breakdown they are soon converted into large cavities opening toward the vagina; rarely they produce large tumors in the parametrium. Occasionally the infection spreads in the lymphatics, converting them into hard cords which run to the pelvis.

FIG. 181. — CARCINOMATOUS ULCER (ulcus rodens), INVOLVING THE LEFT COMMISSURE, THE POSTERIOR LIP, AND THE ADJOINING VAGINAL VAULT. (From a preparation in the Kgl. Universitäts-Frauenklinik in Berlin). ½. (Original.)

The bladder is reached quite late, either through the anterior vaginal vault or the supravaginal portion of the anterior cervical wall; while the rectum is involved comparatively rarely by way of the posterior parametrium. Extension by continuity to the peritoneal cavity also takes place comparatively late.

The lymph glands affected in carcinoma of the vaginal portion are the hypogastric and iliac, rarely the sacral glands.

The internal organs are attacked very rarely and very late in carcinoma of the vaginal portion, the lungs and the liver more frequently than any other.

II. Carcinoma of the Cervix. Carcinoma of the cervix has its origin in the mucous membrane of the cervix, or the elements lying underneath in the cervical tissue. The cancer grows in a variety of ways in the cervical substance, and infiltration alternates with degeneration, so that from the diagnostic standpoint the following clinical pictures are differentiated:

1. Infiltrating carcinoma represents a thickening of the entire cervix or of one wall; or it may form nodes in the cervix and cause a partial enlargement of the structure. At first there is no ulceration, and the node is everywhere covered with intact mucous membrane. This gradually becomes thinner, infection takes place from behind, and the node finally breaks down (Fig. 182). Infiltrating Carcinoma.

2. A carcinomatous cavity in the cervix results from rupture of an infiltrating carcinoma that has undergone degeneration, or when a superficial carcinoma penetrates into the tissues at one point and rapidly undergoes degeneration. The cavities occupy the cervix and communicate with the cervical canal, and in rare cases also with the vagina. The cervical canal is usually crowded against the sound wall and part of it merges with the cavity.

Fig. 182.—Infiltrating Carcinoma of the Cervix. ⅓. (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.)

3. Carcinomatous ulceration within the cervical canal (internal cervical carcinoma) begins in every part of the mucous membrane lining the entire canal, and at the same time penetrates but a short distance into the tissues and rapidly breaks down. The cervical canal enlarges to form a cavity of the wall of the cervix, and in many cases is not infiltrated at all but becomes gradually thinner from within outward; while in other cases infiltration is more marked and goes on hand in hand with the degeneration toward the canal (Fig. 184).

Fig. 183.—Carcinomatous Cavity in the Cervix, Resulting from Degeneration of an Infiltrating Carcinoma. ½. (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.)

Lines of extension. Continuous extension of cervical carcinoma along the surface takes place exclusively toward the uterine body, the internal os offering no obstacle to the progress of the cancer. In superficial carcinoma of the mucous membrane (3) particularly, the disease often secondarily involves the entire inner surface of the uterus. The body may also become involved by direct spreading of the carcinoma in the substance of the uterus, successive portions of the body becoming infiltrated and undergoing degeneration until they form part of the cavity. Metastases Lines of Extension.

are not infrequent both in the substance and in the mucous membrane (Fig. 185). The inner surface of the cavity is rough from the presence of papillary proliferations, nodular thickening and projection of the walls; the walls of the cavity are hard and thickened, depending on the degree of infiltration; at the beginning of degeneration the cavity is represented merely by a broad cleft in the midst of the infiltrated tissue. Extension to the vagina on the surface of the mucous membrane, over the external os, never takes place. On the other hand, in advanced cases the neoplasm, as in carcinoma of the cervical portion, extends into the submucous tissue, making its way gradually downward, preferably along the anterior wall; metastases in the vaginal mucous membrane are rare. The pelvic connective tissue is attacked from the periphery of the cervix first at the point where the carcinoma has penetrated most deeply; it becomes involved latest in superficial mucous membrane carcinomata, and earliest in the presence of deep infiltration of one wall; extension within the pelvic connective tissue takes place in the same way as in carcinoma of the vaginal portion. The bladder early becomes involved in the morbid process, particularly in the case of carcinoma of the anterior wall; while the rectum is not attacked until the disease has become quite extensive in the pelvic connective tissue. The peritoneal cavity long resists the infection; the iliac glands are the first to suffer. Metastasis to internal organs occurs in the same way as in cancer of the vaginal portion.

FIG. 184.—ULCERATING CARCINOMA BEGINNING IN THE MUCOUS MEMBRANE OF THE ENTIRE CERVIX. ⅔. (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.) (Original.)

FIG. 185.—ULCERATING CERVICAL CARCINOMA BEHIND THE CLOSED EXTERNAL OS OF A NULLIPARA, WITH METASTASIS IN THE BODY. ⅔. (Original.) (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg, Prussia.)

Carcinoma of the Body.

III. Carcinoma of the Body. Carcinoma of the uterine body always begins in the mucous membrane and manifests itself in three different ways, depending on the extent of the part that is primarily diseased.

1. Diffuse carcinoma results from uniform disease of the entire corporeal mucous membrane. Nodular thickening or villous

proliferations form on the mucous membrane; the wall slowly becomes infiltrated, and the accompanying inflammatory reaction leads to thickening of the entire uterus, until finally the carcinoma emerges from the outer surface of the uterus in the form of large or small nodes and grows toward the abdominal cavity; the uterine cavity dilates as the result of breakdown of the neoplasm (Fig. 186).

Fig. 186.—Diffuse Carcinoma of the Uterine Body. ⅔. (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.)

2. Circumscribed carcinoma results from disease of a circumscribed portion of the uterine wall, the rest of the uterus remaining absolutely healthy. In rare cases the affected portion is smaller than a *mark* (quarter of a dollar). The neoplasm appears in the form of nodular tumors with irregular, rough or villous surface, or a circumscribed ulceration surrounded by infiltrated tissue (Fig. 187).

Fig. 187.—Circumscribed Carcinoma of the Uterine Body. ⅔. (Specimen from the Kgl. Universitäts-Frauenklinik in Berlin.)

3. Polypoid carcinoma is very rare and usually secondary. The polyp is usually attached by a thin pedicle to a circumscribed portion on the uterine wall and distends the cavity as it grows. The tumor is soft, friable, and breaks down on the surface; it does not extend far down into the tissues; the remainder of the mucous membrane is healthy, or at most ulcerated at the surface as the result of inflammation (Fig. 189).

Polypoid Carcinoma.

Lines of extension. Within the uterus itself the cancer grows either chiefly into the uterine wall or toward the cavity. Carcinomata that have a tendency to grow toward the free cavity produce less infiltration of the wall (Fig. 182 and 188), while those which spread toward the uterine wall rarely lead to the formation of large neoplasms within the cavity (Fig. 186). The tendency to spread on the surface is not very great. Primary diffuse carcinomata are the only ones that occasionally overstep the internal os and spread toward the

Lines of Extension.

cervix. As a rule they are arrested at the internal os. Extension downward into the tissues meets with much less resistance, but the process is slow and it takes a long time before the entire wall becomes completely infiltrated. In the pelvic connective tissue the disease may be limited to the broad ligament proper if the carcinoma reaches the periphery of the uterus exactly in the lateral aspect or if the disease attacks the areas between the muscles and the loosely attached peritoneum. From this point infection takes place in the form of nodular thickening. The deep portion of the parametrium can be infected only by way of the cervix. The peritoneum over the entire outer surface of the body may become diseased if the carcinomatous nodules extend so far. Adhesions with adjacent organs, omentum and intestine, form at these points, or with the parietal peritoneum. In this way the tumor becomes adherent to the intestines, and perforation may take place. The bladder and rectum are attacked very late. The glands which become involved in carcinoma of the body are the lumbar glands, situated on the vertebral column around the aorta; very rarely the inguinal glands become involved by way of the lymphatics which reach the inguinal canal along with the round ligament, if the carcinoma develops in that portion of the uterus which is drained by these vessels. The ovaries not infrequently become the seat of metastasis, probably by way of the lymphatic anastomoses. Metastasis to internal organs is practically the same as in cancer of the vaginal portion and cervix.

FIG. 188.—CIRCUMSCRIBED CARCINOMA IN A SMALL SENILE UTERINE BODY. ⅔. (Original.) (Preparation from the Kgl. Universitäts-Frauenklinik in Berlin.)

FIG. 189.—POLYPOID CARCINOMA OF THE UTERINE BODY. Metastasis from an ovarian carcinoma. (From a specimen in the Kgl. Universitäts-Frauenklinik in Berlin.) ½. (Original.)

Diagnosis and Differential Diagnosis of Cancer of the Uterus.

The diagnosis of cancer of the uterus involves more responsibility n any other. Every mistaken diagnosis, and even a delayed diag-

nosis, costs a human life, because the cancer may in the meantime have become inoperable. The physician must, therefore, make every effort to recognize the cancer correctly at the first examination, under all circumstances and with the employment of every known diagnostic aid. Among the aids which are within the reach of the practising physician I include also consultation with an experienced colleague. The practice of keeping under observation a patient presenting suspicious symptoms of cancer in the hope that the destructive tendency of the growth may show itself, as was formerly done, must at the present time be regarded as a technical error. Cancer Symptoms.

A positive diagnosis can only be made by objective examination; nevertheless, there are a number of symptoms, so-called *symptoms of cancer*, which render the diagnosis very probable. The relation of these symptoms to the diagnosis is peculiar. They do not confirm the diagnosis, but merely help to indicate that a carcinoma is probably present. If the symptoms are found, an accurate examination must under all circumstances be made, with the special object of seeking the cause of the symptoms in a cancer.

The routine examination of every patient who consults a physician on account of gynecological symptoms would offer the surest means of recognizing cancer in time; but for various reasons, already explained, it is impossible to adopt such a policy in practice. Under all circumstances, however, the physician should insist on making an internal examination at once if there is the slightest suspicion of cancer. Nothing should deter him from making such an examination—neither lack of time, nor his own convenience, nor lack of confidence in his technique or ability to make a correct diagnosis, nor even the fact that the patient happens to be bleeding. Every neglect to make an examination delays the diagnosis, particularly as the patient herself makes enough objections to the examination as it is. Some women are ashamed, or afraid of pain; others dread a serious diagnosis or the physician's counsel to undergo an operation; others resort to any excuse that occurs to them in order to escape the hated examination. If the physician listens to these objections or is unable to overcome them, the examination is put off, and a loss of time which may be dangerous to the patient is incurred. The physician must be anxious to examine and must be able to overcome the patient's objections and bend her to his will; his will-power will be strengthened by a suspicion that a given case may possibly be a cancer, and this suspicion is aroused by a knowledge of the symptoms of carcinoma. In this sense, the symptoms of carcinoma play an important part in the diagnosis.

The symptoms of carcinoma are *bleeding after coitus*, caused by mechanical injury of the carcinoma, or engorgement of the vessels during coitus and subsequent rupture. It is very common and not infrequently the first symptom noted in cancer of the cervix, and although it occurs occasionally with hyperemic erosion, endometritis accompanied by severe bleeding, or with polyps, it should always arouse the suspicion of cancer. Of equal importance is *metrorrhagia* after the menopause, at least if it occurs several months after the cessation of the menses. While this symptom is not exactly pathognomonic of cancer, as it also occurs in myomata and polypoid disease of

the vessels when the mucous membrane is very thin and easily injured, it is nevertheless in the great majority of cases due to cancer. Irregular hemorrhages without any connection with menstruation are quite common in cancer, but occur in so many other diseases also that they cannot be regarded as a particularly important symptom of carcinoma; nevertheless, they are an indication for examination, and the older the woman the greater the probability that a cancer will be found. Special kinds of vaginal discharge also point to cancer. A necrotic, bloody discharge with tissue débris is rather characteristic of rapidly degenerating carcinoma and is of little value for early diagnosis; but a serous sanguinolent flow, resembling beef brine, occurs in the very early stages of cancer of the cervical portion and is rare in any other condition.

I have frequently had occasion to observe that among inexperienced physicians two factors play a quite unjustifiably important rôle in the diagnosis of cancer; the cancerous cachexia and the well-known 'forty years.' Against these I wish to sound a special warning. Cachexia occurs only in very late stages, and is therefore of no value for an early diagnosis; and the age is neither in favor of nor against the diagnosis of cancer, as the disease may occur at any period of life, from twenty years to extreme old age.

The clinical diagnosis of cancer of the uterus is based on the demonstration of its two chief characteristics,—the neoplasm and degeneration. The former appears in the form of proliferations on the surface, or infiltration of the ground substance. The latter begins on the surface and leads to softening of the newly formed tissue; or it begins in the centre of the infiltration, which ruptures, with the formation of a large carcinomatous cavity. The tendency of carcinomatous tissue to undergo central and peripheral degeneration is responsible for a peculiarity which has great diagnostic value, namely, the friability of the tissue. It is recognized by the sound penetrating the tissue, and by the fact that the slightest pressure with the finger destroys and breaks it up. This property of breaking up into small pieces under the influence of pressure is observed in no other tissue, except possibly in myomata in a state of advanced degeneration, in which I have seen a similar phenomenon. Another property of exposed carcinomata, which may occasionally be of diagnostic value, is their tendency to bleed at the slightest touch. A carcinoma of the vaginal portion bleeds whenever it is touched somewhat roughly with the sound, with the edge of a speculum, or even when the vaginal walls are separated for the purpose of inspection. The same is true of cervical carcinoma. In carcinoma of the body sounding is often followed by hemorrhage of considerable severity. As, however, hemorrhage is

Physical Signs.

produced by the same causes in cases of erosion, endometritis, and polyp—although the bleeding is less profuse—a diagnosis cannot be based on this sign. When the two peculiarities of cancer—neoplasm and degeneration—are distinctly present, the diagnosis is easy; but if one of them is absent, *i.e.*, if there is proliferation or infiltration without degeneration, or if the base of the ulcer is not infiltrated, the diagnosis may be very difficult and clinically impossible. In order to demonstrate these two clinical properties of cancer we resort to palpation and inspection, which are both important methods, but not in the same degree. A beginning cancer, particularly of the vaginal portion, is often more easily recognized by inspection, and therefore requires careful examination with the speculum. In advanced cancer, on the other hand, the signs obtained by palpation are usually very marked, while inspection may be deceptive because subvaginal infiltration can be felt, but cannot be seen, and the wall of infiltrated tissue often hides the carcinomatous cavities from view. In such cases inspection must always be combined with palpation. It is obvious that the diagnosis of a uterine cancer is easier the more readily it is accessible to the finger and to the eye. If the cancer is situated in the outer surface of the vaginal portion, or if the os is dilated and the finger can be introduced into the cervix, it is usually easy to feel an ulceration and infiltration; whereas, if the cervix is closed and the neoplasm is situated in the body of the uterus, it is impossible to demonstrate its presence by palpation and inspection. Hence the methods employed for the diagnosis of cancer must be varied according to the seat and development of the neoplasm. If clinical methods of examination fail to yield a positive result, resort must be had to microscopic examination of the diseased tissue.

I. The Diagnosis of Cancer of the Vaginal Portion.

The diagnosis is easiest in this situation because the changes are readily recognized by touch and sight. This is particularly true of the cauliflower tumors, which project like polyps from the substance of the vaginal portion, especially if the surface of the tumor is broken down. If the latter is rough, if the tumor breaks up easily and yields to the pressure of the finger, and if the sound penetrates the tissue without any trouble, the condition is unquestionably carcinoma. If the carcinoma is flat and situated on the outer surface of the vaginal portion, any proliferation beyond the level of the mucous membrane is suspicious (Fig. 190). As a rule, these carcinomatous portions also differ from normal tissue by their greater hardness. If the neoplasm is situated within the substance of the vaginal portion, in other words, in cases of infiltrating carcinoma, a cartilaginous consistency of the growth is character-

Diagnosis.

istic; at the same time, the shape of the portio vaginalis is altered and the structure becomes broad and shapeless. These changes are most easily recognized if they are confined to individual portions, while in the others the shape and consistency remain normal. So long as the carcinoma is covered with intact mucous membrane the diagnosis is exceedingly difficult, although the surface has a peculiar bluish tint and exhibits scattered yellow areas corresponding to cancer-nests that have undergone fatty degeneration. As soon as ulceration begins in the surface, all doubt disappears. Carcinomatous ulceration of the vaginal portion is easily recognized by the cavities with uneven, rough and ragged walls which are produced. If the surrounding tissue is hard, the changes are so characteristic that the diagnosis can be made by a single touch; but if the cavity is not large enough to admit

Fig. 190.—Beginning Cauliflower Cancer on the Anterior Lip of the Vaginal Portion. (Original.)

the finger, beginning degeneration can nevertheless be seen in the speculum. Instead of the smooth mucous membrane of the vaginal portion one sees fissures with sharp jagged edges, often covered with a yellowish exudate; or the normal border of the os is replaced by a ragged ulcer (Fig. 191). In these cases also the deeper degeneration can be recognized by the want of resistance in the tissues when the suspicious spots are tested somewhat vigorously with the finger, or by the fact that the sound penetrates the tissue without any difficulty; or pieces can easily be removed with the curette. Friability of the tissue is always suspicious of cancer. The most difficult cancers to recognize are those which appear in the form of flat ulcers, because numerous other processes also produce flat ulcerations in the vaginal portion. The characteristic features of carcinomatous ulcer are its sharp, and in places jagged border; bright red, or, in the presence of degeneration, yellowish-gray, slightly nodular surface; and the moderate depth and infiltrated floor of the ulcer.

In a considerable number of cases the above-mentioned clinical signs are not sufficient for a positive diagnosis. In such cases a piece is excised from the suspicious spot and the diagnosis is made by the histologic picture. The ability to make a correct diagnosis in rare cases of this kind, without resorting to the microscope, grows in direct proportion with one's clinical experience. A physician with limited experience ought, if he were in the habit of making accurate examinations, to see a great many doubtful speculum pictures and feel a suspicious hardness in a great many cases; and for this reason, he ought to resort more to the microscope in the diagnosis of cervical cancer than the expert specialist.

Fig. 191.—Carcinomatous Ulceration of the Vaginal Portion. (Original.)

A number of different conditions must be considered in the **differential diagnosis,** depending on whether the cancer to be differentiated belongs to the polypoid, infiltrating, or ulcerating form.

Polypoid carcinomata (cauliflower tumors) may give rise to confusion with the rare forms of papillary tuberculosis of the vaginal portion, which also lead to proliferation in both lips of the external os. On account of their irregular surface and infiltrated floor they may closely resemble a cauliflower tumor. Occasionally the characteristic elements of tuberculosis are seen either in the neoplasm itself or in the immediate neighborhood, as in the shape of pearly nodules the size of a millet seed; and in the intervals between these nodules is seen the caseous greasy material which results from the breaking down of tuberculous tissue. The differential diagnosis can, therefore, be made only after very careful inspection. Quite often the diagnosis remanis in doubt and a microscopic examination

Polypoid Carcinomata.

must be made, by means of which tubercle nodules, and frequently also bacilli, are found in the excised piece of tissue. Occasionally the demonstration of tuberculosis in the tubes and in the peritoneum, or the finding of a tuberculous focus in other organs, may make the diagnosis possible.

FIG. 192.—MULTIPLE MUCOUS POLYPS OF THE CERVIX. (Original.)

Gaebel mentions a papillomatous tumor of the vaginal portion which was very like a cauliflower cancer and which owed its origin to infiltration with the ova of Bilharzia. The absence of discharge, of ulceration, and of infiltration in the neighborhood, according to this author, suffices to guard against mistaking the condition for a cancer.

FIG. 193.—FOLLICULAR POLYP FROM THE POSTERIOR LIP OF THE CERVIX. (Original.) (Ovula Nabothi on the anterior lip and surrounding the external os.)

Occasionally mucous polyps of the cervix, filling the entire external os, may resemble a cancer if the surface is nodular. On close inspection, however, the surface is found to be smooth and covered with mucous membrane, and on careful sounding it is easy to demonstrate that they are composed of individual mucous polyps which originate in the cervix (Fig. 192).

A cervical myoma with a broad pedicle may protrude from the vaginal portion. Such a tumor is distinguished from carcinoma by its smooth covering of mucous membrane, which may occasionally become gangrenous, and especially by its firm consistency and absence of friability.

Follicular hypertrophy of the vaginal portion leads to the production of large tumors in circumscribed portions of the cervix. The surface is not rough or nodular, the consistency is not friable, and the tumors are covered with smooth mucous membrane, through which the dilated follicles can sometimes be seen. After rupture of the latter, irregular retractions are produced here and there on the surface, as in the tonsils. In these cases the microscope occasionally has to be consulted (Fig. 193).

Acuminate condylomata may simulate a carcinoma of the vaginal portion if, as occurs most frequently during pregnancy, they are closely packed and represent a circumscribed tumor on the external surface. In such a case they form a true neoplasm with irregular surface, but the base is not infiltrated and there is no true ulceration, only a papillary surface with thick epithelium. The color is usually whitish-red. The diagnosis is simplified by the fact that the condylomata are found in other portions of the cervix or in the vagina and vulva (Fig. 194).

FIG. 194.—PAPILLOMA (condyloma acuminatum) OF THE VAGINAL PORTION IN A PREGNANT WOMAN. (Original.)

FIG. 195.—EROSION WITH SLIGHTLY PAPILLARY SURFACE. (Original.)

Infiltrating carcinomata are most likely to be confounded with inflammatory affections (metritis colli), particularly if the vaginal portion becomes nodular from the presence of lacerations or notches, or swelling of the parts between. The inflammatory changes always affect the entire vaginal portion uniformly. The consistency is not so cartilaginous and elastic as in the case of carcinoma, and the cervix is covered with smooth mucous membrane. The palpatory findings are very similar to those obtained in carcinoma

Infiltrating Carcinoma.

produced by infiltration of the vaginal portion with dilated follicles, particularly as the structures may have a nodular feel on account of the projecting follicles. The similarity is increased by the fact that these changes usually do not involve the entire vaginal portion and the consistency may be very tense; but with the speculum it is seen that the structure is covered with smooth mucous membrane, with here and there follicles shining through, which on being punctured exude a tenacious mucus; in doubtful cases the microscope must be consulted.

Flat carcinomatous ulcers without accompanying infiltration are often very difficult to distinguish from other ulcerations of the vaginal portion. It requires long clinical experience to be able to interpret an ulcer of the vaginal portion with certainty, and even the practiced

Fig. 196.—Simple Ulcer in Process of Cicatrization. (Original.)

diagnostician is forced to consult the microscope more frequently than in any other condition. In order to show the difference from carcinomatous ulcers (see page 348, and Fig. 191) I shall describe the clinical characteristics of other kinds of ulcers and similar processes.

Erosions (Fig. 195) are in the main easy to distinguish from cancerous ulcers; they may resemble the latter, however, if they develop on a hard inflammatory base, if they are associated with ectropion, or their surface becomes rough and nodular by the formation of thick papillæ (erosio papillaris). Inspection with the speculum decides the diagnosis. An erosion usually surrounds the external os uniformly and, owing to its epithelial covering, has a reflecting surface and bright red color; while a carcinoma, even if the ulceration is quite superficial, is more dull in appearance and the surface is rougher. Erosions have no sharp edge and merge gradually with the squamous

epithelium of the vaginal portion; their outline is irregular, and on the surface islands of epithelial follicles, or follicular ulcers, are not infrequently seen. If the erosion has lost its epithelial covering, or purulent infection of the surface or incrustation with scabs has developed, the diagnosis is more difficult. Under these circumstances the microscope occasionally has to be consulted.

Decubital ulcer (Fig. 196) (ulcus simplex) occurs in cases of prolapse and forms irregular lacerated ulcers, often involving large portions of the vagina. The external os itself is often free from ulceration, while in carcinoma this portion is usually attacked first. Decubital ulcers are usually separated by a sharp line from the thickened epithelium and the hypertrophied vaginal portion of the floor is ulcerated and often covered with a pale yellowish exudate. At the periphery

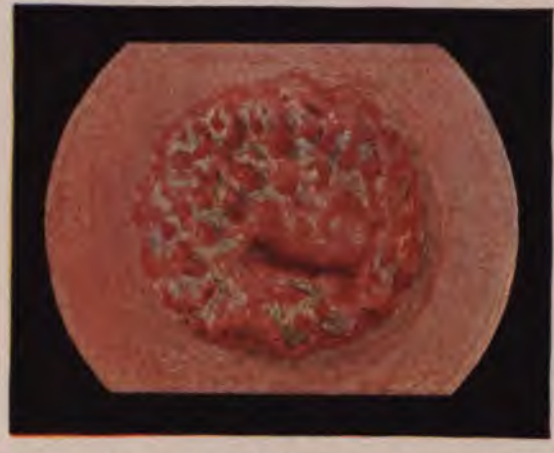

Fig. 197.—Tuberculous Ulcer of the Vaginal Portion. (Original.)

cicatrization is often seen, and in the middle, islands of epithelium. In contrast with carcinoma, the floor of the ulcer is entirely free from infiltration, and a few days after replacement of the prolapse distinct signs of healing are observed in the form of peripheral epidermidalization. Decubital ulcers may also be produced in a normally situated vaginal portion by the use of ill-fitting pessaries. These ulcers are immediately underneath the arch of the pessary, oval in shape, with a greasy floor. They heal rapidly after removal of the pessary. The ulcers remaining after the separation of a piece of mucous membrane in croupous or diphtheritic processes, or after cauterization, differ from carcinomatous ulcers by the presence of the remains of gangrenous, white mucous membrane which still adheres to them, and the absence of all infiltration.

Tuberculous ulceration (Fig. 197), we must admit, is exceedingly rare, and produces a picture very similar to that of carcinoma. It also surrounds the external os; the edges are sharp and

frequently undermined, resembling tuberculous ulcer of the intestine. The floor of the ulcer is yellowish, slightly granular and uneven, but not infiltrated. On the floor of the ulcer, as well as in the surrounding tissue, yellow miliary tubercles are frequently seen. An important support to the diagnosis is found in tuberculous disease in other organs, particularly coincident tuberculosis of the uterus and tubes. The specific structures of tuberculosis and the tubercle bacilli, which are easily recognized in the microscopic picture, afford positive signs of a tuberculous disease.

FIG. 198.—CHANCROIDS ON THE POSTERIOR LIP OF THE CERVIX AND ANTERIOR VAGINAL WALL (after Heitzmann).

Chancroids (ulcera mollia) (Fig. 198) are usually small ulcers, sometimes becoming larger by confluence, with a slightly indented, somewhat elevated border. The floor of the ulcer is lardaceous and diphtheritic, but not infiltrated. The fact that the ulcers are multiple, the presence of contact ulcers and the simultaneous appearance of similar ulcers in the vagina, especially in the external genitalia, are all fairly characteristic of chancroid.

Syphilitic ulcers occur in the vaginal portion in three different forms: initial lesion (sclerosis), degenerated papule, and gumma. An ulcerated and degenerated primary sore (Fig. 199) is not rare in the vaginal portion. It is characterized by the fact that it is solitary and has a hard consistency at the base. On close inspection

it reveals itself as a shallow ulcer with an indistinct border and dirty, brownish-red color, and the floor is sometimes covered with a greasy exudate. In multiparæ with patulous external os the ulcer may extend far up into the cervical canal (Neumann). The anterior lip is the favorite site. Papulous ulcers (Fig. 200) are somewhat elevated above the level of the vaginal portion, and the surface is covered with whitish or yellowish, broken-down tissue. These ulcers are usually multiple, and along with them are seen other papules in the vagina and particularly on the vulva, which have not undergone ulceration. Gummata on the vaginal portion are exceedingly rare. Neumann describes them as ulcerations occurring in the neighborhood of the external os, both on the anterior and on the posterior lip, and often surrounding both lips at the same time. The ulcers which result from gummata are elliptical and sharply outlined, shallow, or somewhat

Fig. 199. — Syphilitic Primary Sore on the Anterior Lip of the Cervix (after Neumann).

Fig. 200. — Condylomata Lata of the Vaginal Portion (after Stratz).

depressed, and the floor is usually covered with a puriform exudate, separation or removal of which often leaves a spongy granulation which bleeds freely. The distinction from carcinoma is based on their situation to one side of the external os, the sinuous outline of the ulcer, rapid degeneration, crater-like depression, and peripheral extension with serpiginous border. In all specific processes the diagnosis is rendered very probable by the demonstration of specific affections in other places. The microscope will occasionally have to decide. The finding of spirochæta pallida particularly appears to afford positive support to the diagnosis.

II. The Diagnosis of Cervical Cancer.

The diagnosis of cervical cancer is more difficult, particularly if it is deeply situated in the cervical substance and is inaccessible to the palpating finger on that account, or because the os is closed. Cancers which have ulcerated and opened toward the outer surface of the

vaginal portion are no more difficult to diagnose than ulcerating cancers of the vaginal portion itself; they are easily recognized by the rough, ragged friable walls of the cavity, particularly if the surrounding tissue is infiltrated. Similarly the diagnosis is easy in those cases in which the finger can be passed from the cervical canal into the cavity, or the entire inner surface has undergone carcinomatous degeneration. In these cases also a nodular thickening, with rough surface and friable consistency, is felt. If the lower portion of the cervical canal can be seen in the speculum, the true nature of the ulcerative surface can be recognized by the absence of epithelium. The rough and sometimes greasy appearance of the lower, jagged edge of the ulcer just appears at the external os. The friable consistency of the wall is most easily demonstrated by means of the curette. If large pieces of tissue can be removed with the curette by gentle pressure, the tumor is undoubtedly a carcinoma. The microscope is rarely needed in such cases.

Diagnosis of Cervical Cancer.

Infiltrating cancers which occupy part of the cervical wall, but are everywhere covered with mucous membrane, are difficult to recognize. The diagnosis in such cases must be based solely on the change in shape and the consistency; the cervix becomes distended, thick and shapeless, sometimes only on the affected side, and the cervical canal is crowded over to the other side. The consistency is as hard as cartilage and often elastic. Infiltration of the supravaginal portion of the cervix is best recognized by rectal examination. If the carcinoma approaches the vaginal portion, the investing mucous membrane at this point often becomes distinctly bluish and shows yellow points which correspond to degenerated cancer nests. Quite often, however, the mucous membrane is bright red, loses its gloss, and the superficial layers are readily stripped off. If the carcinoma comes still nearer the mucous membrane, the latter breaks down, the cancer is exposed, and the appearance becomes similar to that of a primary cancer of the vaginal portion. In these infiltrating carcinomata it often becomes necessary to excise a piece for microscopic examination. A completely closed os offers a serious obstacle to the recognition of cervical carcinoma, particularly the forms without marked infiltration of the cervix which ulcerate toward the cervical canal, and above all internal cervical carcinomata. From a diagnostic standpoint these cases occupy the same position as carcinoma of the body. Either an attempt is made to dilate the external os for the purpose of introducing the finger, or—a better plan—a piece of tissue is removed with the curette and examined under the microscope. As it is impossible to differentiate between these cases and carcinoma of the body clinically, it is better to curette the entire body at the same time, and conversely, in cases that suggest carcinoma of the body the

upper portion of the cervix should also be examined. I distinctly remember two cases in which only the body of the uterus was curetted again and again, always with the result that only benign changes of the mucous membrane were demonstrated with the microscope, while a cancer was developing undisturbed in the upper portion of the cervix.

Differential Diagnosis. The chief source of diagnostic errors is found in the infiltrating carcinomata. They may be confounded with metritic changes and follicular hypertrophy, the physical signs of which have been described on page 351. Interstitial myomata situated in the wall of the cervix may also give similar palpatory signs. They also cause partial thickening of the cervical wall, but they are more round, more sharply outlined, and surrounded by soft tissue; whereas carcinoma, owing to its processes and the inflammatory reaction, merges more diffusely with the surrounding tissue. In doubtful cases the microscope decides. Ulceration is always in favor of carcinoma. Degenerated carcinomata of the mucous membrane may, in the absence of marked infiltration, give palpatory signs similar to those obtained in chronic cervical catarrh in old women. In this condition also the mucous membrane feels rough, uneven, and nodular, from the glandular depressions and thickening of the intervening portions of tissue. As a rule, however, the surface is not so ragged as in carcinoma, and in the speculum the normal sheen of the mucous membrane is observed. If the curette is introduced into the cervical canal for the purpose of testing the friability of the tissue, it does not bring away any part of this tissue. Here again the microscope must speak the last word.

III. Diagnosis of Cancer of the Body.

This diagnosis is often missed because the possibility of such a cancer is not thought of. Even if the physician recognizes the importance of the above mentioned symptoms of carcinoma and examines the woman for cancer, he is often satisfied if he fails to find one in the vaginal portion or in the cervix. It is true that cancers of the body are less frequent than cervical cancers in the proportion of about one to fifteen, but they are nevertheless frequent enough to demand a searching examination if suspicious symptoms are present. These are somewhat more striking in this condition, particularly the hemorrhages, as most corporeal cancers develop after the menopause. Another very suspicious and almost pathognomonic symptom is found in Simpson's pains, *i.e.*, regular, labor-like pains, lasting several hours, and recurring at a definite time of the day. But no matter how striking the symptoms may be, the diagnosis must always be based on objective examination. To begin with, it should be emphasized that there are no characteristic bimanual

Diagnosis of Cancer of the Uterine Body.

palpatory findings in cancer of the body. In the early stages the size of the uterus may be absolutely normal, and even a senile, atrophied uterus may contain a neoplasm. In the advanced stages the viscus is thicker, larger, more tense, and often distinctly nodular; but it does not materially differ from myoma or a metritic uterus. Even when the carcinoma forms protuberances on the outer surface of the uterus, the condition cannot be positively distinguished from a subserous myoma by the sense of touch. The diagnosis of corporeal cancer can be made only by means of an internal examination of the cavity. This is always begun with the sound. In circumscribed places, or on the entire inner surface, irregularities are found which occasionally differ from the irregularities formed by the retention of decidual tissue, or those seen in fungous endometritis, by their hardness, their nodular character, and by the fact that they give the sensation as if the instrument were gliding over a projection and down into a depression. Occasionally one gets the impression that the head of the sound is penetrating into the tissue. While these findings are never a proof of carcinoma, and should only serve to induce the examiner to resort to other methods of examination, carcinoma can practically be excluded with certainty if the entire endometrium is found to be absolutely smooth; if irregularities are found, a microscopic examination must follow. There is no objection to employing the microscope if the symptoms are very suspicious, even if no roughness is discovered with the sound. Microscopy is the sovereign method in the diagnosis of corporeal cancer. Its use can be dispensed with only in those cases in which the cervix is open and the protruding mass is unquestionably carcinomatous, or digital exploration is absolutely conclusive. Digital exploration of the uterine cavity may give positive information in complicated cases. The finger encounters circumscribed or diffuse thickening in the uterine wall, or the hard infiltrated border and floor of a carcinomatous ulcer, or villous papillary proliferation filling the entire cavity, or tumors with rough surface and friable consistency. Small, soft, polypoid carcinomata are more difficult to recognize, and carcinoma of the mucous membrane in the earlier stages may entirely escape the exploring finger. In all cases in which the cervix opens spontaneously, digital exploration of the uterine cavity should be employed; but if there is the slightest doubt, or the findings are negative, an exploratory curettement for the purpose of microscopic examination must follow. If, however, the cervix is closed, the diagnosis should first be made by the result of exploratory curettage; and only if the microscopic diagnosis is not positive, should dilatation and digital exploration be employed. The advantages are all on the side of the former method, partly because exploration is more dangerous than curettage, and partly because the palpatory

findings are much more likely to give rise to an error in diagnosis than a microscopic examination in the hands of an expert pathologist.

The **differential diagnosis** in carcinoma of the body is therefore almost exclusively based on the histologic findings; if a digital exploration is employed, it must be remembered that sarcoma of the mucous membrane, degenerating myoma, mucous polypoids, and the remains of abortions may yield similar physical signs. From all these conditions, which are described in detail in their respective chapters, carcinoma of the body is distinguished by the combination of neoplasm and degeneration. If the cervix is insufficiently dilated and constricts the palpating finger, it may be impossible to feel the finer differences of the above tumors.

Diagnosis of the Extension of Uterine Cancer.

Diagnosis of the Extension of Uterine Cancer.

After the diagnosis of cancer of the uterus has been made there arises the question whether it is confined to its original site or has already attacked the adjoining organs. The possibility of removing the cancerous focus at all, or at least with any prospect of permanent cure, depends on the question whether the disease has spread outside of the uterus or not. It is true that such progress has been made in operative technique, and the primary results, even of our most radical operations, are now so good that we venture to follow the cancer everywhere with the knife, stopping only when we reach the bony pelvis. The exact determination as to whether the cancer is still confined to the pelvis no longer has the same value which it had about ten years ago, when no operation was attempted if cancer could be demonstrated anywhere outside of the uterus; nevertheless, the operator at least cannot afford to neglect this question, because the prognosis of the operation still depends on the extent to which he is obliged to carry it, and because the permanent result is even more closely dependent upon the extent of the cancer. For the family physician the point is not so important, and we advise him to let the operator decide this question, on which the life or death of the cancer patient depends, particularly as the operative indications are still far from being well established, and the necessary methods of examination may be beyond the ability of an ordinary doctor.

The examiner must be familiar with the various lines of extension which cancer of the vaginal portion of the cervix and the body (see page 337, et seq.) may follow, and be able to trace the course of the infection. The cancer may spread within the uterus, or may extend to the vagina, bladder, rectum, lymph glands and, by metastasis, to internal organs.

The spread of the cancer within the uterus is of importance only to those operators who remove only the cervix in certain forms of

cancer of the vaginal portion. The examination is made by determining the boundary between the infiltrated and normal tissue by bimanual palpation of the supravaginal segment of the cervix; through the rectum the thickened or distended portion can be distinctly differentiated from the healthy part, which is slender and less hard. Extension along the mucous membrane can be recognized with the finger or with the sound by the cessation of roughness; metastases in the mucous membrane can also be occasionally demonstrated with the sound, whereas in the tissue of the uterus it is practically impossible to recognize them.

Uterus.

Involvement of the vagina is readily discovered by palpation. Beginning at the vaginal portion the vaginal vault is infiltrated, or the surface is rough and nodular up to a distinct boundary line which separates it from the healthy, smooth vaginal wall; superficial ulcerations are best recognized by inspection. In submucous extension of the cancer infiltration and breaking down of the diseased portion of the vagina are easily detected by palpation, the separation below from healthy mucous membrane being formed by a cartilaginous ring. Inspection is often deceptive in this condition because the infiltration is covered with normal mucous membrane. Metastases in the form of hard movable nodules, ranging in size from that of a lentil to that of a walnut, and covered with bluish mucous membrane, are found chiefly in the posterior wall. Occasionally they appear in the fold surrounding the meatus, where they form subvaginal nodes which surround the urethra and after a time ulcerate.

Vagina.

Extension to the bladder is easily recognized if the vesico-vaginal or vesico-cervical septum has been perforated and a fistula has formed. It can be inferred in cases of advanced carcinoma with a fair degree of certainty, if there is severe vesical catarrh, bloody urine, or pronounced irritative symptoms in the bladder. It is much more important, however, to make as early a diagnosis as possible of the vesical disease, partly in order to limit the operation in that direction, and partly because it may modify the operative technique to be employed. The only reliable method of examining the condition of the bladder is cystoscopy, with the aid of which it is possible to recognize changes in the bladder wall which are a positive sign that the carcinoma is approaching from without. Extension to the wall of the bladder occurs in the following manner: Over the spot where the carcinoma is approaching the bladder from without, *i.e.*, usually the floor of the bladder on the left or right side, next to the trigonum Lieutaudii, the mucous membrane swells and forms thick, parallel folds which gradually increase in height, leaving deep depressions between them (Fig. 201). The mucosa then becomes edematous, covered with vesi-

Bladder.

cles, the epithelium separates, and a picture similar to that of bullous edema is produced. These advanced alterations may be present without a sign of cystitis. Much later small nodules the size of a lentil, or flat, elevated areas, appear in the mucous membrane and are easily recognized as carcinomatous by their medullary appearance and peculiar reflex. The surface of this area is traversed by blood-vessels. If ulceration is superadded, the surface of these nodes becomes rough and covered with white, more or less firmly adherent shreds of tissue or incrustations (Fig. 202); extensive cystitis is usually present at the same time. While these changes in the bladder wall do not justify the inference that the carcinoma has spread to the tissues outside of the uterus generally, the presence of well-marked folds, and particularly of bullous edema, are positive signs that the vesicocervical septum is diseased.

FIG. 201.—CYSTOSCOPIC PICTURE OF THE VESICAL MUCOUS MEMBRANE WHEN A CARCINOMA IS IN CONTACT WITH THE VISCUS. (Modified after Zangemeister.)

FIG. 202.—CYSTOSCOPIC PICTURE OF A CERVICAL CARCINOMA THAT HAS INVADED THE BLADDER. The cancer is covered with incrustations of salt and surrounded by bullous edema.

With the aid of chromo-cystoscopy, furthermore, it can be determined whether the carcinoma involves the ureter. If the latter is still intact, its function is not disturbed; but if the stream of urine is entirely absent, it may be assumed that the ureter is surrounded and compressed by the carcinoma (Hofmeier).

Ureter.

The diagnosis of involvement of the rectum in uterine carcinoma is usually easy if a rectal examination is made. As infection of the rectum occurs by continuity from without, the tube maintains its full mobility so long as it is not involved; as soon as the outer layers of the wall are attacked, the mucous membrane becomes immovable; finally nodules form within the mucosa, and by breaking down give rise to discharge of blood and putrescent fluid.

Rectum.

The parametrium is the most important factor in the extension of cancer, because changes in the parametrium, more frequently than anything else, limit the possibility of operation. Undoubtedly

opinions have undergone a change on this point, and whereas formerly no operation was ever performed in a case of uterine cancer if the parametrium was positively known to be diseased, we now regard only the most advanced stages of parametritis as counterindicating radical abdominal hysterectomy. It is therefore important, not to decide whether the parametrium is diseased or not, but rather to determine whether the disease has advanced to such a degree that there is no longer any prospect of a primary, or at least of a permanent result, if operation is performed. This question has not as yet been answered unanimously, and the many examinations that have been made show that the first beginning of carcinomatous disease in the parametrial tissue cannot be recognized by clinical methods. While we are, therefore, not in a position to say definitely that the parametrium is diseased, we can never be sure that it is healthy. As it is the posterior portions of the pelvic connective tissue that are usually attacked, combined examination through the vagina is rarely successful, and a positive opinion with regard to the condition of the parametrium, particularly in the earlier stages of disease, can only be formed if the vaginal vault is soft and yielding and the abdominal parietes are very thin. The examination should, therefore, be made chiefly through the rectum. In order to make an accurate palpation of the portions of the pelvic connective tissue situated high up, alongside of the cervix, it is usually necessary to introduce the palpating finger beyond the fold of Kohlrausch. If the examiner is unable to reach high enough with one finger he must employ two, and that is possible only in anesthesia; but as it would weaken the patient too much to give her a general anesthetic shortly before the major operation, this method must be limited to cases that are really doubtful. The examination consists in introducing one or two fingers high up into the rectum and at the same time placing the thumb in the vagina so as to grasp the parametrium from both sides, while the other hand assists in the examination from without. In this way, very slight changes in the parametrium can be discovered. So long as the parametrium is healthy the fingers can easily be brought together immediately alongside of the cervix, and the soft connective tissue, the round contour of the healthy cervix, and the normal or slightly stretched folds of Douglas can be felt. Conversely, however, it is not justifiable to conclude from such findings that the parametrium is quite intact; for the earliest changes demonstrable only with the microscope are, of course, imperceptible and cannot be recognized even by the most accurate palpation. Freedom from carcinoma as determined clinically does not coincide with microscopic integrity of the tissues; if large portions of the carcinoma have already advanced beyond the cervix, the adjoining parametrium is thickened and forms together with the cervix, a hard nodule of

Parametrium.

irregular outline; the roundness of the cervix at this point disappears and the outline becomes irregular; thick bands of tissue extend to both sides and backward. In a still more advanced stage the nodular bands, as thick as a finger, are felt extending, and closely attached to, the pelvic wall. At the same time the examiner determines with the thumb, which is introduced without much force into the carcinomatous cavity through the vagina, whether the destructive process extends beyond the normal contour of the cervix into the parametrium; or, in other words, whether the ulcerated cavity is still confined to the cervix or not (Fig. 203). On account of the differences in the contour of the cervix and in the consistency of the parametrium on the two sides (Fig. 204), the diagnosis is easiest in those cases in which the parametrium is soft on one side and infiltrated on the other. More rarely the alterations in the parametrium are confined to a few isolated thick bands of adhesions passing from the folds of Douglas to the pelvis, and occasionally interrupted by a few nodules; these bands correspond to carcinomatous lymph vessels surrounded by a zone of inflammatory reaction. In cases of very extensive infiltration of the parametrium not accompanied by disintegration of the tissues toward the vagina, extensive tumors of the consistency of cartilage and with nodular surfaces are felt occupying the entire space between the uterus and the pelvic wall, particularly the posterior portions of the pelvis. It is difficult to decide by palpation whether the carcinoma in its advance toward the bladder has gone beyond the cervix and invaded the anterior parametrium; but it may be surmised if the anterior wall is destroyed and the remaining layer, by a simultaneous examination through the bladder with the catheter and through the cervix with the finger, is shown to be very thin. The earliest beginnings of the extension in this direction are recognized with the cystoscope. A much less reliable sign of disease of the parametria is fixation of the uterus, *i.e.*, loss of its normal mobility. It is true that when the parametrium is absolutely healthy, the uterus is quite movable and can easily be drawn down to the vulva; but even after that portion of the parametrium which is in contact with the cervix has been attacked by carcinoma, while the lateral portion is

FIG. 203.—ADVANCED CARCINOMA OF THE CERVIX INVOLVING THE PARAMETRIUM ON BOTH SIDES. P.-F. ½. (Original.) The cervix and the adjoining portions of the parametrium on both sides form a large cavity, around which the entire connective tissue as far as the pelvis is infiltrated.

still free, the normal mobility of the uterus is practically preserved; fixation does not occur until the infiltration reaches the pelvis, and even at that stage errors in regard to the degree of mobility are not infrequent. Moreover, inflammatory affections, which are so extraordinarily common, produce the same fixation of the uterus. The degree of mobility is of some value as a measure of the technical difficulties that may be expected in a vaginal operation, but it is worthless as a sign that the cancer has spread to the parametrium. The mobility of the uterus is investigated by seizing the healthy portion of the portio vaginalis with a double tenaculum and having an assistant draw it down while the surgeon makes an examination through the rectum and abdominal walls, if possible under anesthesia.

FIG. 204.—CARCINOMA OF THE CERVIX AND OF THE ENTIRE LEFT PARAMETRIUM. P.-F. ⅓. (Original.) The carcinoma, originating in the left wall of the cervix, has invaded and infiltrated the connective tissue as far as the pelvic wall, while the right side is completely free.

The diagnosis of carcinomatous disease of the parametrium sometimes presents great difficulties. Subserous myomata in the peripheral portion of the cervix and adjoining parametrium may produce the same signs as when the carcinoma has invaded the pelvic connective tissue at this point. Under anesthesia it is usually not very difficult to distinguish the round contour of a myoma from the diffuse outline of a carcinoma. The differential diagnosis is very difficult when the myoma is surrounded by exudates. Disease of the adnexa very often simulates carcinomatous infiltrations of the parametrium, particularly when the thickened tube or the ovary has dropped into Douglas' space and is surrounded by exudates and adhesions to the peritoneum in the neighboring folds of Douglas. As a rule the consistency of these tumors is not so cartilaginous as that of carcinomatous infiltration, and the connective tissue and cystic tumors can be referred without hesitation to the adnexa. The carcinomatous infiltration is in immediate contact with the vaginal vault, and situated in the horizontal portion of the parametrium alongside of the cervix; whereas adnexal tumors are usually felt somewhat higher up, are not adherent to the lateral aspect of the cervix, and contain some soft connective tissue, providing the latter is not involved in the inflammation. It is possible occasionally to separate adnexal tumors of this kind from their adhesions, when they may be differentiated from the uterus, and the

thickened tube traced as far as the cornu. The greatest difficulties are encountered in attempting to determine whether a thickening in the parametrium is carcinomatous or inflammatory. Extensive infiltrations or tumors in the pelvic connective tissue are usually inflammatory, particularly when they have broad attachments to the pelvis or develop in regions which are not usually reached by carcinoma, *i.e.*, the recto-vaginal septum, and the anterior and lateral portions alongside of the bladder. The consistency of inflammatory tumors, instead of being cartilaginous, is soft during the early stages, and fibrous and unyielding in older processes; the shape is usually flat, while carcinoma is round or nodular. The thickened bands which represent infiltrated lymph vessels, either of a carcinomatous or an inflammatory nature, frequently both, are difficult to interpret. One of the most reliable factors in the diagnosis of infiltration of the connective tissue is the continuity of the process with the carcinomatous focus at the cervix; if the infiltration is found on the side on which the carcinoma has locally advanced farthest in the vagina, or if by means of bimanual palpation a direct connection between the carcinomatous cervix and the thickening in the connective tissue is made out, or if the fingers introduced through the ulcerated cavity enter the thickening in the connective tissue, there is no doubt about the carcinomatous nature of the disease.

Extension of the carcinoma to the glands and the corresponding lymphatic region depends to a certain degree on the variety of the carcinoma and its local extension. Glandular involvement occurs earliest in cervical, and latest in corporeal cancer; while simple carcinoma of the vaginal portion occupies an intermediate position. So long as the carcinoma spreads only within the uterus, glandular disease is rare; as soon as the first carcinomatous foci develop outside of the uterus, glandular diseases become more frequent, and their frequency increases steadily in proportion as the carcinoma advances in the parametrium. As the earliest carcinomatous foci in the parametrium are not recognizable clinically, one must be prepared to find glandular involvement even when the parametrium feels soft and healthy; it is, therefore, impossible to give exact figures with regard to the frequency of glandular involvement. The figures obtained thus far range between 20 and 60 per cent. From a diagnostic standpoint, it is more important to know that carcinomatous glands have been found in 19 per cent. of cases in which the parametria were histologically free from cancer, in 22 per cent. of those cases in which the parametria were only clinically healthy, and in over 50 per cent. of cases of clinically demonstrable carcinoma in the parametria. We are not as yet in a position to give a correct general figure. Satisfactory

Glands.

palpation of the iliac glands is possible only in profound anesthesia by introducing two fingers high up into the rectum and advancing toward the sacro-iliac articulation, the abdominal walls being at the same time forcibly depressed from the outside at the corresponding point; if the glands are distinctly felt they are always enlarged. As a rule, they give the impression of tumors the size of a walnut, single or in groups, very hard and almost immovable, usually on the side where the carcinoma has invaded the parametrium. Very rarely parametrial lymph glands are found between the uterus and the pelvic wall in the form of movable nodules of hard consistency, ranging in size from that of a lentil to that of a pea; palpation of these glands is always very uncertain. Examination of the inguinal glands is quite easy; they are frequently enlarged, indurated, at first movable and during the later stages adherent and, by infection of the neighborhood, produce large tumors which break down in the centre and become soft. The skin over the glands is adherent and reddened until finally spontaneous rupture takes place. The glandular enlargement may be mistaken for an inflammatory process, which is so common in this region; but the hardness and the fact that the glands remain movable for a comparatively long time are in favor of carcinoma. The lumbar glands can be felt only when the intestines are empty and the abdominal walls are thin and poor in fat, as immovable hard nodules on the vertebral column. Personally, I have never succeeded in feeling them. The finding of enlargement or induration of the glands, especially of the pelvic glands, is however by no means a proof that the enlargement is carcinomatous; for chronic inflammations produce the same changes. On the other hand it has often been shown that glands of a normal size and consistency may contain the first beginnings of a carcinoma. This fact, in connection with the great difficulty of feeling the glands at all, materially detracts from any diagnostic and prognostic importance that may attach to a clinical examination of the glands.

The examination for metastasis is of no importance whatever in uterine cancer, because it does not occur until after the cancer has gone beyond the uterus. The earliest stages cannot be diagnosticated, and metastasis can only be inferred from certain symptoms, such as hemoptysis and hematemesis. After the metastatic tumors have attained a certain size they can sometimes be demonstrated by the methods of examination employed in internal medicine. The metastases which occur in the ovary, particularly in carcinoma of the body, are more important because they can easily be removed by operation; in these cases ovarian tumors with the clinical signs of malignancy are found.

Internal Organs.

Diagnosis of Recurrence.

As the indications for operation are extended more and more in the treatment of uterine cancer, the diagnosis of recurrence becomes more and more important to the practicing physician, and this phase of the subject will therefore be discussed at this place.

Recurrence in the narrow sense of the term is applied to the reappearance of the cancer at a point where it was not demonstrable before the operation; in the wider sense, however, the term includes also the subsequent growth of the cancerous masses left behind at the operation. I shall adopt the general custom and use the term in its wider sense. Definition.

Recurrence may be *local*, when the cancer reappears at the original site or at some point in the wound produced at the operation; the cancer may recur in the *lymph glands* in any part of the entire body; or there may be *metastatic* recurrence, when the tumor, extending by way of the blood paths, appears in some internal organ, in the case of uterine cancer most frequently in the liver, lungs, kidneys, stomach, bones, ovary, and peritoneum. Clinically, in view of the difference in the symptomatology, we distinguish a *closed* and an *open* recurrence. The former develops behind the closed vaginal tube in the depths of the true pelvis; the latter leads to the formation of an ulcerative cavity communicating with the vagina. Classification.

The symptoms of cancer, which have been described and which have some value as suggesting the existence of carcinomatous disease, are of still greater importance in the diagnosis of recurrence, because, after removal of the uterus, the healthy vagina alone rarely gives rise to hemorrhage and discharge. These two symptoms occurring after an operation for the removal of cancer, are very ominous and are associated with a third very suspicious symptom, namely, rheumatoid or sciatic pains in one leg or in one hip, which appear particularly when the tumor recurs in the depths of the pelvic connective tissue, and later pronounced edema of one lower extremity. Grave cachexia, in the absence of bleeding or discharge, should arouse a suspicion of metastatic recurrence. All these symptoms are of value as suggesting the existence of disease, the diagnosis of which can, of course, only be made by an examination. Diagnosis.

Local superficial recurrence in the mucous membrane of the vagina is exceedingly rare; it takes the shape of papillomatous or flat infiltrations with nodular, friable surfaces, resembling carcinoma of the vaginal portion, and trenchantly separated from the healthy mucous membrane. Granulations in the scar or in the tubes that have been sutured into the angles of the wound—with ectropion of the mucous membrane, which bleeds at the lightest touch—should Local Recurrence.

arouse a suspicion of recurrence, but the granulations usually feel softer to the touch. In such cases the microscope often has to be consulted. In a few cases I have observed a rare form of recurrence after extirpation of carcinoma of the vaginal portion, with extension to the vaginal vault. The actual appearance of the secondary tumors in these cases was preceded by diffuse thickening of the mucous membrane, which presented a papillary and velvety appearance; the affected portion looked as if it had been flayed, and merged insensibly with the healthy mucous membrane. This stage, which the microscope showed to be still a benign thickening of the epithelium, was in every instance followed in a short time by carcinomatous disease of the affected portion. More frequently the secondary tumor develops in the subvaginal tissue, where it produces roundish nodules of cartilaginous consistency and great mobility, projecting into the lumen of the vagina, and at first covered with mucous membrane. These nodes very soon rupture into the vagina and produce characteristic carcinomatous cavities with infiltrated edges.

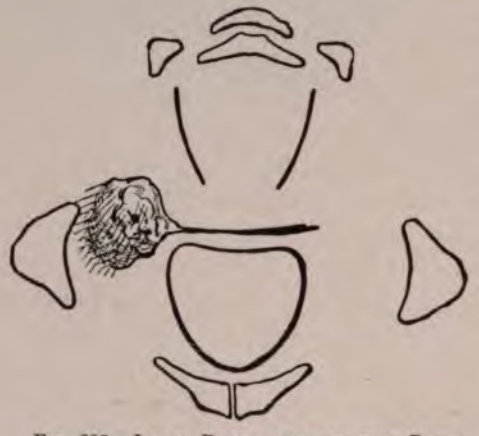

FIG. 205.—LOCAL RECURRENCE IN THE RIGHT PARAMETRIUM, AFTER TOTAL EXTIRPATION OF THE UTERUS. P.-F. ⅓. (Original.) The secondary tumor developed from a small germ left behind near the right angle of the wound.

If the tumor recurs in the deeper portions of the pelvic connective tissue, the site of predilection being the anterior parametrium and the base of the broad ligaments, the nodes are at a greater distance from the vaginal canal. They are usually felt through the vagina as circumscribed tumors of cartilaginous consistency, often loosely connected to the pelvic wall (Fig. 205). If there is any suspicion of recurrence, a rectal examination must not be neglected, because the first beginning of the secondary tumor in immediate contact with the pelvic wall can only be recognized in that way. Nodes of recurring cancer not infrequently make their appearance in Schuchardt's incision. Sometimes extensive infiltrations of the entire pelvic tissue are found, which develop in large portions of the parametrium (Fig. 206), have a cartilaginous consistency, are sometimes nodular, early lead to thrombosis of the femoral vein, and cause severe pain and early cachexia. Circumscribed recurrence in the parametrium may easily be confounded with inflammatory thickening in adnexa that have been left behind; but the latter are usually softer, and partially cystic, and occasionally the tube and ovary

can be made out. Recurrences in the bladder are recognized with the aid of the cystoscope. The findings are described on page 361. When a secondary nodule approaches the bladder, the mucous membrane is thrown

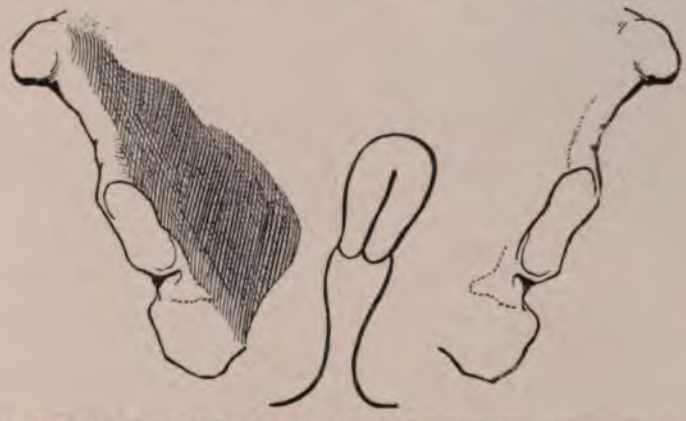

FIG. 206.—RECURRENCE IN THE RIGHT PARAMETRIUM, AFTER SUPRAVAGINAL AMPUTATION OF THE CERVIX (Inoculation Recurrence). P.-F. ⅓. (Original.)

into folds, and bullous edema appears just as in the case of extension of a primary carcinoma of the cervix to the vesicocervical septum.

Glandular recurrence appears either in the iliac or in the lumbar glands, depending on what part of the uterus is attacked, and

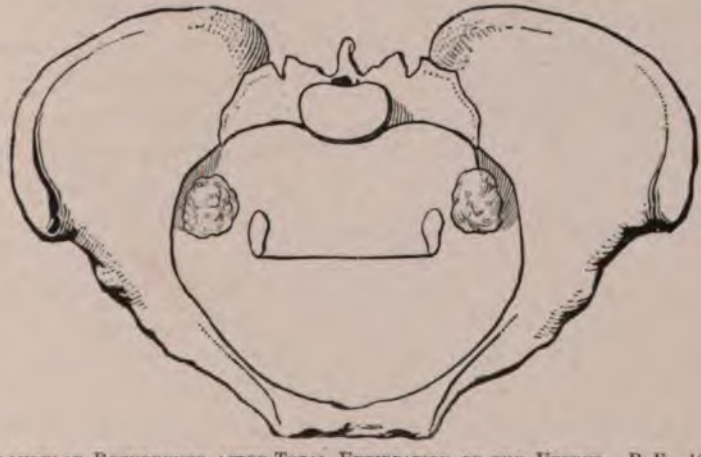

FIG. 207.—GLANDULAR RECURRENCE AFTER TOTAL EXTIRPATION OF THE UTERUS. P.-F. ⅓. (Original.) Glandular masses at the pelvic wall on each side; to the inner side of the glands the two ovaries.

there produces changes similar to those found in the diseased glands with the primary uterine cancer. Recurrent carcinoma in the iliac glands can be recognized only by a combined examination through the rectum in complete anesthesia (Fig. 207).

The diagnosis of metastatic recurrence is fraught with the same difficulties as that of metastases in general.

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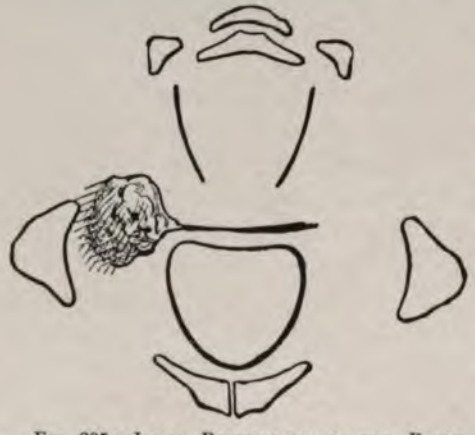

FIG. 205.—LOCAL RECURRENCE IN THE RIGHT PARAMETRIUM, AFTER TOTAL EXTIRPATION OF THE UTERUS. P.-F. ½. (Original.) The secondary tumor developed from a small germ left behind near the right angle of the wound.

If the tumor recurs in the deeper portions of the pelvic connective tissue, the site of predilection being the anterior parametrium and the base of the broad ligaments, the nodes are at a greater distance from the vaginal canal. They are usually felt through the vagina as circumscribed tumors of cartilaginous consistency, often loosely connected to the pelvic wall (Fig. 205). If there is any suspicion of recurrence, a rectal examination must not be neglected, because the first beginning of the secondary tumor in immediate contact with the pelvic wall can only be recognized in that way. Nodes of recurring cancer not infrequently make their appearance in Schuchardt's incision. Sometimes extensive infiltrations of the entire pelvic tissue are found, which develop in large portions of the parametrium (Fig. 206), have a cartilaginous consistency, are sometimes nodular, early lead to thrombosis of the femoral vein, and cause severe pain and early cachexia. Circumscribed recurrence in the parametrium may easily be confounded with inflammatory thickening in adnexa that have been left behind; but the latter are usually softer, and partially cystic, and occasionally the tube and ovary

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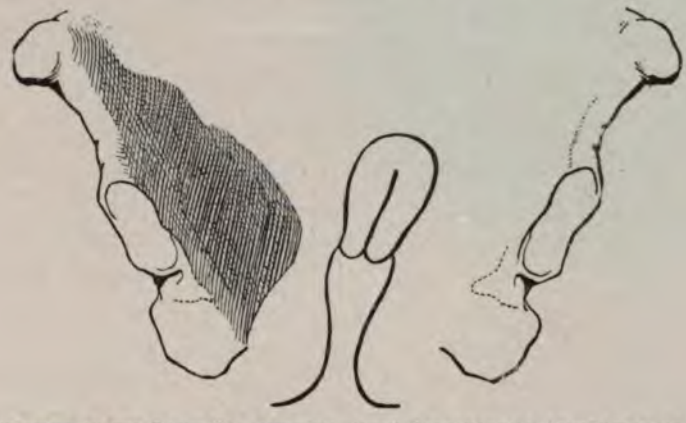

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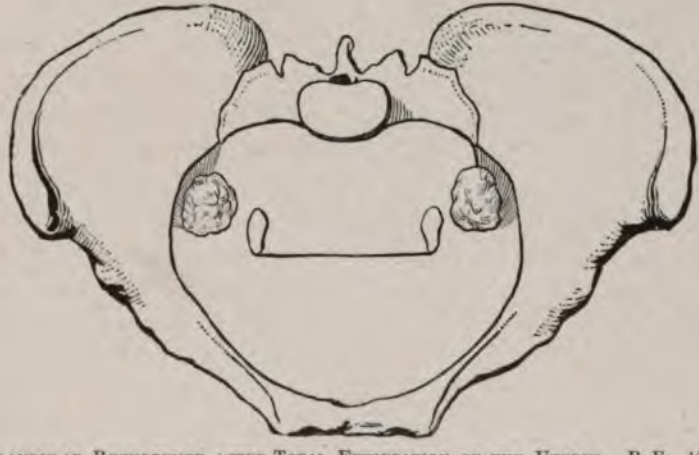

FIG. 207.—GLANDULAR RECURRENCE AFTER TOTAL EXTIRPATION OF THE UTERUS. P.-F. ⅓. (Original.) Glandular masses at the pelvic wall on each side; to the inner side of the glands the two ovaries.

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The diagnosis of metastatic recurrence is fraught with the same difficulties as that of metastases in general.

II. Sarcoma of the Uterus.

Sarcoma is much more rare than carcinoma of the uterus and differs from the latter in that the neoplasm occupies the uterine body very much more frequently than the cervix. Before discussing the diagnosis proper, we shall again describe the

Clinical Pictures and Lines of Extension.

Sarcoma of the vaginal portion, beginning in the outer surface of the structure, is extremely rare. It takes the same forms as carcinoma, most frequently that of the cauliflower tumor, and can therefore be identified as sarcoma only with the microscope. Even the histologic differences are so slight that there is some reason to doubt whether it is to be regarded as a separate pathologic entity at all.

FIG. 208.—RACEMOSE SARCOMA OF THE CERVIX (after Pernice). ½. The tumor is attached to the vaginal portion; a sound has been passed into the cervical canal; the outer surface is in places covered with adherent shreds of epithelium.

Sarcoma of the cervix appears in two different forms: polypoid tumors with a more or less extensive attachment to the wall, of soft consistency and smooth surface; and a racemose sarcoma peculiar to the cervix, which grows out of the part in a coherent mass and produces in the vagina a conglomeration of vesicles and nodules of various sizes, spreading gradually in the lumen of the canal (Fig. 208). The size of the vesicles, or small cysts, and the length of the pedicle by which they are attached, vary; sometimes they are translucent, at other times dark blue from infiltration with blood.

Sarcoma of the Cervix.

The entire structure closely resembles a hydatid mole. Later the sarcoma spreads to the parametrium and sometimes produces metastases by way of the blood paths. Racemose sarcomata are very often mixed tumors composed of mesodermal derivatives.

Sarcoma of the Uterine Body.

Sarcoma of the uterine body begins in the mucous membrane or within the uterine wall.

Sarcoma of the mucous membrane in rare cases has a diffuse origin and causes flat proliferation of a papillary, villous character, either in the mucous membrane itself or underneath the mucosa, causing it to bulge toward the uterine cavity. A more fre-

quent form is polypoid sarcoma, which is circumscribed from the beginning and produces tumors that fill and in their further growth distend the uterine cavity and, after dilating the cervical canal, grow into the vagina. The tumors are soft, of lobulated structure, and in the early stages covered with intact mucous membrane; later they break down and ulcerate (Fig. 209).

Sarcoma of the Mucous Membrane.

Mural sarcoma in the majority of cases results from degeneration of a preëxisting myoma, and may appear in any one of the three forms of that tumor. Much more rarely the sarcoma results from degeneration of the constituents of the uterine wall, chiefly the blood-vessels; but the existence of this form as a separate variety is still open to question.

Mural Sarcoma.

The clinical pictures, which are also produced by sarcomatous degeneration of myomata, have been described on page 289. Pure mural sarcomata are usually observed as multiple nodules, with the remains of uterine muscle in the intervals between them.

FIG. 209.—MUCOUS MEMBRANE SARCOMA OF THE UTERINE BODY (from a specimen in the Kgl. Universitäts-Frauenklinik in Berlin). ⅓. (Original.) The sarcoma occupies part of the wall and has produced polypoid tumors within the uterine cavity.

At first sarcoma of the mucous membrane tends to grow toward the cavity of the uterus, within which it spreads out and thus produces enlargement of the uterus; much later it involves the muscle, which in the meantime has often become greatly hypertrophied, and slowly works its way through the uterine wall. As it continues to grow it breaks through the serous covering and leads to the production of nodular tumors alongside of the uterus, which become adherent to the intestines and bladder and may later perforate into these organs. This tendency to grow toward the uterine cavity is to a slight degree observed also in mural sarcomata, but their chief line of extension is through the muscle itself; sometimes they also reach the abdominal cavity. Sarcomata resulting from the degeneration of myomata in the main retain the direction of growth of the myomata. Interstitial tumors ultimately also break through the wall and enter the abdominal cavity.

Lines of Extension.

Metastases occur usually by way of the blood paths and are observed in about one-fourth of the cases of advanced mucous sarcoma, the sites of predilection are the lungs, intestines, and peritoneum. Disease of the lymph glands is more rare. Mural sarcomata much more frequently lead to metastases, especially in the lungs, liver, and intestines.

Diagnosis and Differential Diagnosis.

Diagnosis and Differential Diagnosis.

Sarcoma of the vaginal portion is identical with carcinoma and can be distinguished only with the microscope. Polypoid sarcomata of the cervix are recognized by the soft polypoid masses which grow into the vagina; they may be very similar to myomata if the shape remains round, but in that case the consistency is much softer. From carcinoma they are distinguished usually by the fact that ulceration takes place much later and by their pronounced tendency to grow toward the cavity. Infiltration of the base and surrounding tissue is very much rarer in sarcoma than in carcinoma.

FIG. 210.—MYOSARCOMA OF THE UTERINE BODY (from a specimen in the Kgl. Universitäts-Frauenklinik in Berlin). ½. (Original.) The wall contains an interstitial myoma which, on the side toward the uterine cavity, is the seat of carcinomatous degeneration.

Racemose sarcoma of the cervix, when fully developed, is easily recognized by its characteristic appearance. By palpation and inspection alone the growth may be mistaken for a hydatid mole about to be expelled; but if the base can be palpated, the tumor can easily be recognized by the absence of any connection with the cervical wall. Signs of pregnancy, especially of enlargement, are found in the uterus. The diagnosis is more difficult if the racemose stage, which of course depends on the free development of the tumor in the vagina, has not yet occurred. The mass may be still quite coherent, or just beginning to break up into individual lobules, and, as it appears in the os, may be mistaken for a mucous polyp, which sometimes has a similar shape. The microscope often has to decide.

Mucous carcinoma of the uterine body is heralded by certain symptoms which, as in the case of carcinoma, suggest the development of such a tumor and demand a careful examination. These symptoms are irregular hemorrhages, particularly in the menopause, and persistent discharge of bloody serum. The diagnosis is made in the same way as that of cancer of the uterine body. Bimanual palpation.

in case the tumor is small, may be entirely negative; whereas, if the tumor is large, a uniform enlargement of the uterus, usually with a soft consistency, is discovered. A positive diagnosis of sarcoma is possible only by means of microscopic examination of the tissue removed from the uterus, or by digital exploration of the cavity. The histologic diagnosis in this case is the more reliable, but is undoubtedly more difficult than in the case of carcinoma, and the results of microscopic examination frequently have to be controlled by exploration. If the cervix is open, the latter should never be omitted; if the uterus is found to contain diffuse tumors of soft consistency, and an irregular, but usually smooth surface into which the finger can penetrate, the condition is sarcoma. Circumscribed sarcomata frequently cannot be distinguished from softened myomata or mucous polyps by the sense of touch, and the diagnosis must be decided by the microscope.

The diagnosis of mural sarcoma resulting from the degeneration of a myoma has been described at length on page 371. Mural sarcomata not developing on a myomatous foundation are at first mistaken for interstitial myomata because they produce great enlargement of the uterus, and the distinction between the two will depend chiefly on finding the signs of malignant degeneration.

Fresh diagnostic difficulties arise when the sarcoma breaks through the uterine wall producing soft tumors alongside of the body which, depending on their size, consistency, and connection with neighboring structures, may be mistaken for ovarian tumors, hematoma, or exudates.

III. Chorionepithelioma of the Uterus.

(Syncytioma malignum.)

Chorionepithelioma originates in the epithelial covering of the chorionic villi and unites in itself the two different components of those structures,—the cells of Langhans and the syncytium. The tumor therefore presupposes the presence of an ovum within the uterus. Pregnancy may have terminated in abortion or gone on to term; but in by far the greater number of cases the tumor develops on the soil of a previous hydatid mole. As the disease begins not in the ovum itself, but in the constituents which have been left behind in the uterine mucosa or wall after its expulsion, the growth of the tumor may begin a long time after the termination of pregnancy.

Clinical Pictures and Lines of Extension.

Chorionepithelioma at first leads to proliferations at the site of implantation in the form of soft vascular tumors infiltrated with blood and growing into the cavity of the uterus, where they enlarge according

to the available space and entirely fill the cavity (Fig. 211). Horizontal extension in the neighborhood is rare. At the same time the neoplasm infiltrates the uterine wall, which breaks down; in rare cases the tumor continues its growth outside of the uterus and leads to the production of similar neoplasms on the external wall, or in the broad ligament.

The growth spreads mainly by way of the uterine veins, which are completely filled by the epithelial masses of the tumor, producing erosion of the vessel walls. Particles of the tumor are distributed by the various anastomoses, with the production of metastatic tumors, especially in the vaginal wall. If they reach the vena cava they are carried into the branches of the pulmonary arteries and produce

Fig. 211.—Chorionepithelioma of the Posterior Uterine Wall. (Original.) (Specimen from the Kgl. Universitäts-Frauenklinik, in Königsberg.)

metastases in the lungs, which are practically never absent. Next to the lungs the favorite seats are the brain, liver, and spleen.

Diagnosis and Differential Diagnosis.

The clinical diagnosis is based on the demonstration of a disintegrated tumor of the uterine wall which owes its origin to a previous pregnancy. By examination it is determined that the tumor is composed of the elements of chorionepithelioma. The clinical signs are rarely sufficiently positive to form the sole basis of the diagnosis, which must be confirmed with the microscope. Quite often there is a total absence of clinical symptoms, and the diagnosis rests entirely on the microscopic findings.

As in other forms of malignant disease, the symptoms consist of irregular hemorrhages or the discharge of bloody serum. Since

they usually follow a pregnancy, they may be misleading, because they point to retention of placental tissue or fetal parts. Early occurrence of fetal decomposition, with septic or pyemic fever, is not uncommon, as chorionepithelioma is very vascular and easily breaks down. The signs of increasing decomposition soon give the clinical picture a malignant character, which is enhanced by the occurrence of thrombosis in the femoral vein. Hemoptysis and infiltration of the pulmonary tissue have a peculiar significance because they point to pulmonary metastases, which are practically pathognomonic.

The physical signs when the cervix is closed are entirely negative or limited to moderate enlargement of the somewhat softened uterus, which is also observed regularly in cases of retention of fetal parts. The tumors which make their appearance on the outside of the uterus during the later stages simulate myomata or malignant tumors.

Fig. 212.—Vaginal Metastasis in Chorionepithelioma of the Uterus. ½. (Original.)

Metastatic growths in the broad ligament are usually mistaken for exudates, hematoma, or soft ovarian tumors. They may occasionally be correctly interpreted if taken in connection with the entire clinical picture.

If the cervix is dilated, soft tumors are felt in the uterine cavity, either with a broad or a polypoid attachment to the uterine wall. The surface of the tumor is smooth, lobulated, nodular, and the consistency is brittle, spongy, and friable. As the tumors develop after a pregnancy, the masses are first regarded as retained placenta, from which they do not differ very greatly on naked-eye inspection. Their appearance after the placental masses have been completely removed is very suspicious of chorionepithelioma. The differential diagnosis from other malignant neoplasms, especially sarcoma, must be made by the history and the microscopic findings.

Metastases of the original tumor, particularly vaginal tumors which are easily accessible to examination, play an important part in the diagnosis. They appear in the form of tumors ranging in size from that of a lentil to that of an egg, and are usually submucous with a

bluish reflex, as seen through the mucous membrane (Fig. 212). They grow very rapidly, become immovable and, after the covering of mucous membrane ruptures, undergo ulceration. Metastases of this kind may develop in the vagina and continue to grow while the primary changes in the uterus subside; on the other hand, vaginal tumors, indubitably benign in character, may result from metastases of simple chorionic villi and be associated with chorionepithelioma of the uterus. Hence metastases in the vagina are a positive sign of the transportation of chorionic constituents; but, unless there are other signs of uterine disease, do not indicate the presence of chorionepithelioma in the uterus. Aside from the above mentioned symptoms of a previous pregnancy, the most important event in the history is the expulsion of a hydatid mole. It must be borne in mind that a long period of health may intervene between the pregnancy and the appearance of the chorionepithelioma.

Microscopic examination is far more valuable than clinical signs, particularly in the earlier stages. As the tumors develop imperceptibly from retained fetal parts, and may run their course with the same clinical symptoms, all fetal parts expelled during or after abortion and parturition must be subjected to careful microscopic examination, especially if there is a previous history of hydatid mole. Any patient who has had a hydatid mole should be kept under observation and, at the appearance of the first symptoms, particularly irregular hemorrhages, an exploratory curettage should be performed.

The Neoplasms of the Vagina.

The benign neoplasms of the vagina are the fibromyomata; the malignant are carcinoma and sarcoma.

Fibromyomata are composed of muscular and connective tissue in various proportions and form approximately round tumors up to about the size of an apple. They have a predilection for the anterior wall. The diagnosis is based on finding the origin of such a tumor in the vaginal wall. The consistency is firm, usually hard unless secondary softening has occurred. The tumors are movable so far as the vaginal wall permits and are covered with intact mucous membrane; pedunculated tumors may become necrotic. In their origin and connection with the vaginal wall they resemble vaginal cysts, but differ from the latter by their firm consistency. Cysts on inspection appear bluish through the mucous membrane.

Fig. 213.—Fibroma of the Anterior Vaginal Wall, protruding through the vulva. ½.

Carcinoma may be primary or secondary.

Primary carcinoma of the vagina usually presents itself in the form of flat neoplasms involving either a part or the entire wall, usually the upper portion of the posterior wall. They are circumscribed, with sharp edges, often somewhat elevated above the level of the healthy vaginal wall, and the surface is fissured, uneven and often covered with a greasy, grayish exudate. Mobility is present only during the early stages, and the tumors soon become adherent by extension of the process in the paravaginal connective tissue. The base and the surrounding tissues are slightly infiltrated. More rarely the tumors are large, attached by a broad base to the vaginal wall and gradually distend the lumen of the vagina. This variety is slower to break down and retains its covering of mucous membrane for a long time. Occasionally carcinoma merely takes the form of subvaginal infiltration completely surrounding the canal like a ring. In a few cases I have seen a general superficial carcinomatous change involving the entire wall and consisting in warty tubercles,

Primary Carcinoma.

bleeding at the lightest touch, without infiltration. The boundary between the carcinomatous portion and the healthy mucous membrane is usually very distinct; in only one case the mucous membrane of the entire vestibule was also rough, uneven and bleeding.

The changes produced are similar to those described above, on page 367, as the initial stage of the recurrence in the vagina after extirpation of the uterus.

Secondary vaginal carcinoma results from the extension by continuity of carcinomatous disease of neighboring organs, most commonly the cervix, rarely the bladder, rectum or vulva. Occasionally it occurs in the metastatic form with carcinoma of the body and of the cervix, particularly in the fold surrounding the meatus. Not infrequently carcinoma develops on the completely prolapsed vaginal wall, usually in the form of a flat infiltration of the above described character.

Secondary Vaginal Carcinoma.

Owing to the thinness of the vaginal wall the carcinoma early spreads to the surrounding paravaginal tissue, with the production of flat thickenings which slowly advance toward the pelvic wall, while the part nearest the vagina breaks down. Bladder and rectum are attacked earlier than in cancer of the uterus. The glands that become enlarged in vaginal carcinoma are the hypogastric and, in carcinoma of the lower third, the inguinal glands.

Diagnosis and Differential Diagnosis of Vaginal Carcinoma. The diagnosis is easy because the changes develop on the surface. The infiltration, either in the form of flat tumors occupying the vaginal wall or of nodules, is easily recognized by its cartilaginous consistency and, if ulceration is superadded, the diagnosis is absolutely clear. Some difficulty is occasionally found in the large tumors that are still covered with mucous membrane: their livid appearance and yellow, translucent, punctate areas; the soft consistency; and a certain tendency to crumple, which is recognized most easily by cautiously sounding the tumor with a probe,—all point to malignancy. Quite often, however, microscopic examination of a piece of tumor is necessary.

In the differential diagnosis tertiary forms of syphilis are the most important conditions to consider. The difference between a gumma and a carcinoma is that in the former the ulcerative process is more prominent, and infiltration is either absent altogether or it is diffuse, less hard, and surrounds the ulcer. Gummatous ulcers are not friable; the floor is covered with a grayish, greasy exudate; and the edges are sinuous. Perforation into adjoining organs with the formation of fistulæ occurs early.

Differential Diagnosis.

Tuberculosis of the vagina is rare and has been observed only in a few cases as an isolated focus of infection. The condition produces flat ulcers, with sharply defined and in some places jagged edges, and

discolored surface; occasionally a few pearly tubercle nodules are found near the ulcer. The chief difference from carcinoma is the absence of infiltration. The diagnosis may be cleared up by finding tuberculous foci in other parts of the body and especially by microscopic examination.

The diagnosis between primary vaginal carcinoma and one secondary to cancer of the uterus is based on the fact that in the former the vaginal portion itself is free, except possibly for some ulceration from without on the part nearest the carcinoma.

Sarcoma in adults produces pictures quite similar to some of the forms of carcinoma (see p. 377). It may take the form of a large tumor covered with mucous membrane, which sometimes protrudes from the vulva; or of a diffuse, often circular infiltration of the entire vagina; while circumscribed hard ulcers with firm edges—the commonest form of carcinoma—are not seen in sarcoma. Sarcoma spreads slowly into the deeper tissues and produces metastases in the lungs and in the skin.

Sarcoma.

In children sarcoma occasionally appears in the form of a tumor with a broad base, which later forms racemose excrescences resembling racemose cervical carcinoma and entirely filling the vagina. Fresh nodules appear continually in the neighborhood as a result of infection and also increase in size. Extension to the deep tissues takes place late.

The diagnosis of sarcoma in adults is based on the same findings as that of carcinoma, and the two varieties cannot usually be distinguished clinically. The distinction between sarcoma and benign tumors (particularly fibromyomata) is based on the peculiarities of the latter as discussed on p. 377.

Neoplasms and Ulcerations of the Vulva.

In discussing the diagnosis of the diseases of the vulva it will be better, instead of giving a systematic description of all the various conditions found on palpation and their characteristic peculiarities, to start out with the important general phenomena and, by analysing them, arrive at the differentiation of the individual affections. At a glance the physician will recognize certain manifestations of the disease, such as a circumscribed tumor or a deep ulcer, and will then have to decide by the peculiarities of the ulcer, for example, whether it is tuberculous or a broken-down carcinoma. In carrying out this analytical method the following classification will be the best guide.

Diseases of the vulva in the main appear in three different forms.

1. Inflammatory changes of the mucous membrane.
   Vulvitis, pruritus, kraurosis, psoriasis vulvæ.
2. Circumscribed tumor formation.
   Fibroma, acuminate condyloma, lipoma, sarcoma, carcinoma, elephantiasis, tumors of Bartholin's glands.
3. Ulcerations.
   Carcinoma, syphilis, tuberculosis, rodent ulcer (estiomène).

Although certain diseases, such as carcinoma, appear in both forms, and one may result from the other; and although, on the other hand, it is difficult to classify such a disease as elephantiasis either among neoplasms or among ulcerations, because it combines both changes, I am nevertheless of the opinion that the above classification will prove the best guide to the diagnostician in the large and difficult field of diseases of the vulva, which appear in such a great variety of forms.

The changes in the mucous membrane are discussed under the head of catarrh, and I shall therefore confine myself in this chapter to the diagnosis of tumors and ulcerative processes.

Tumors of the Vulva.

Fibroma.

Fibromata (Fig. 214) most frequently spring from the labia majora and represent round movable tumors of hard consistency, covered with skin or mucous membrane. During the subsequent growth the pedicle elongates and the tumor, projecting from the vulva, may attain the size of a man's head. By the accumulation of fluid within the tissue large tumors often develop a soft, and sometimes even a cystic consistency.

Lipomata resemble fibromata in their outward appearance, are also pedunculated, rarely flat and spread out, and develop most frequently on the labia majora. They are softer than fibromata and often exhibit the granular consistency peculiar to fatty tumors.

Sarcoma, the most frequent seat of which is also the labia majora, represents a tumor which may be exactly like a fibroma and distinguishable from the latter only with the aid of the microscope. If the tumor is diffusely continuous with the surrounding tissue, or if the investing skin is greatly reddened, tense, and immovable, showing that it also is involved, the tumor is probably a sarcoma. Among sarcomata must also be included the melanoma, which may spring from any portion of the vulva and often originates in a nævus.

Sarcoma.

Fig. 214.—Pendulous Fibroma of the Left Labium Majus (after Küstner).

It is characterized by its dark brown or black color, the rapid glandular involvement, and early appearance of general metastases (some cases of melanoma must be classified among carcinomata).

Carcinoma appears in three quite distinct forms.

1. Cancroid represents a more or less prominent neoplasm, on the surface of which papillary proliferation or cornification alternates with ulceration and discharging areas; degeneration occurs late and rarely extends into the deeper tissues. The most frequent seats of cancroid are the inner surface of the labia majora and minora, the clitoris and the fossa navicularis.

Carcinoma.

2. Infiltrating carcinoma represents a large, hard, often prominent tumor with extensive, deep infiltration and active degeneration; the surrounding skin often shows livid discoloration. This variety extends more deeply into the tissues than cancroid and early involves the bones.

3. Carcinomatous ulcer develops from the two preceding varieties by degeneration beginning on the surface. It will be described later.

The glands are usually involved early, in every case the inguinal.

The diagnosis of cancroids usually presents no difficulties. They are recognized by their prominence, hardness, warty surface usually with very little degeneration, and the induration of the inguinal glands. Multiplicity is not against cancroid, because several distinct foci may develop independently or as a result of contact infection. There may be some difficulty in distinguishing between cancroid and psoriasis vulvae (leukoplakia), which represents circumscribed, whitish, somewhat elevated wheals on the inner surface of the greater

FIG. 215.—ACUMINATE CONDYLOMATA OF THE VULVA (after Kûstner).

and lesser labia. These wheals are very often the starting point of cancroid, just as cancer develops on the base of lingual and buccal psoriasis, and after the removal of such a cancer fresh cancroids may develop from other wheals. As there are many transitional forms, it is difficult to say whether a condition is psoriatic or cancroidal; as soon as the surface begins to be papillary and the base shows infiltration, carcinoma should be suspected. The exact time when carcinomatous change begins may often have to be determined by the microscope.

The diagnosis of the infiltration form is based on the cartilaginous consistency, the diffuse character of the surrounding tissue, the pain, the tension and livid discoloration of the skin, the appearance of small foci and the involvement of the lymph glands. These characteristics suffice for the differentiation from benign tumors, but the diagnosis from sarcoma occasionally requires the aid of the microscope.

Acuminate condylomata not infrequently occur in large conglomerations, especially during pregnancy, and form large, cauliflower tumors occupying the entire vulva and the perineum. The epithelium may undergo maceration, with the production of a purulent discharge, giving the tumors a resemblance to papillary cancroid. The latter may however be excluded with certainty by the soft base, the extremely nodular and irregular surface without signs of degeneration, and the isolated papillomata which are almost always present in the neighborhood. In doubtful cases the microscope must decide.

Acuminate Condylomata.

Elephantiasis vulvae leads to the production of cutaneous thickening on the labia majora and minora and on the clitoris, associated with infiltration and soft hypertrophic changes in the subcutaneous

FIG. 216.—ELEPHANTIASIS VULVÆ (after W. Veit). The tumor springs from the mons Veneris, the prepuce of the clitoris, and the right labium minus.

connective tissue. Similar changes are often present around the anus. This new-formation of tissue, which probably depends on stasis in the lymph vessels, leads to the production of circumscribed tumors which protrude from the vulva and may attain the size of a man's head. They are usually attached by a broad base to their point of origin. The surface may be smooth (e. glabra), presenting merely retractions here and there, or irregular and warty (e. papillomatosa). The skin is often translucent, slightly edematous, and as a result of degeneration shallow ulcers or widespread destructions may occur on the surface. The consistency is soft. The diagnosis is based on these findings and is usually not difficult. From cancroid, with which circumscribed papillomatous elephantiasis has a certain resemblance, it is distinguished by the absence of infiltration.

Elephantiasis.

Tumors of Bartholin's glands, as compared with those described so far, have in common their position at the site of Bartholin's gland

from which they spring. Exactly at the site of the gland, *i.e.*, the posterior third of the greater labia a little outside of the hymen, the tumor develops from a small point by concentric enlargement. The outer surface is covered with skin, the inner with the mucous membrane of the labia majora; the upper portion of the periphery is covered by the labium minus. As the tumor increases in size it extends downward under the skin of the perineum.

Tumors of Bartholin's Glands.

The topography is so characteristic that the origin of the tumor is recognized at a glance. On the other hand, it may be difficult to determine the nature of the growth. The following diseases must be considered:

(*a*) Gonorrheal bartholinitis, with occlusion of the duct, leads to retention of pus and the formation of a round, sensitive,

FIG. 217.—ELEPHANTIASIS VULVÆ (after W. Veit). The tumor is elevated, showing the right labium minus fenestrated by the ulcer and forming the inferior point of origin of the tumor. Hypertrophic and hemorrhoidal nodes are seen at the anus.

completely movable, hard tumor. As soon as the infiltration extends to the neighboring tissue and the retention becomes an abscess, the tumor increases in size, becomes adherent to its surroundings, and the skin over it becomes bright red; the consistency is no longer hard, and distinct fluctuation is present. As gonorrhea is the only cause of bartholinitis, the other clinical signs of the disease and the finding of gonococci in the urethra or cervix will at once clear up the nature of the hard retention-tumor.

(*b*) Cysts of Bartholin's glands are recognized by the distinct fluctuation, the transparent or translucent walls, and the absence of inflammatory reaction in the surrounding tissue.

(*c*) Carcinoma of Bartholin's gland is extremely rare and produces a slowly growing, hard tumor in the characteristic situation. Recent neoplasms resemble the hard retention-tumors, while older

cancers are distinguished from the latter by their nodular surface, firm attachment to the underlying tissues, and the tension and livid color of the skin. As soon as the growth ulcerates or glandular metastases are produced, the diagnosis of malignancy is assured. The duct appears to resist the cancerous affection for a long time and is often dilated.

Sarcoma produces the same physical signs; only one authenticated case is on record.

Ulcerations of the Vulva.

Ulcerations result from the breaking down of tissues that have a tendency to degenerate. As degeneration is always due to a specific

FIG. 218.—ABSCESS OF THE RIGHT GLAND OF BARTHOLIN, WITH EDEMA IN THE UPPER AND LOWER SEGMENTS OF THE RIGHT LABIUM MAJUS.

irritant, some newly formed tissue is always present with the degenerated tissue. The clinical pictures observed in ulceration are determined by the intensity of the process of new-formation extending either horizontally or vertically into the tissues, and the rapidity and completeness of the subsequent degeneration. The character of the ulceration can occasionally be determined by finding the specific irritant, such as the tubercle bacillus. Microscopic study of the specific tissue reaction is a most important diagnostic aid.

1. **Carcinomatous ulcers** are characterized chiefly by a marked tendency to new-formation, which appears in the form of an infiltration at the edges and on the floor of the ulcers, as well as in the deeper tissues. The surface is rough, nodular, not ragged; the color is bright red and

in places grayish from the presence of degenerated tissue. The edge of the ulcer is rigid, hard and sharply outlined. Metastatic nodes are rarely found in the neighborhood. In old conditions the lymph glands are usually involved.

2. **Syphilitic ulcer** may develop on the vulva in any of the three stages of syphilis.

The syphilitic primary sore is usually solitary, with a greatly infiltrated, cartilaginous, often disc-shaped base. The surface is a dirty dark red, and shows some desquamation. The ulcer is sharply separated from the surrounding tissue and only occasionally surrounded by edema when situated on the labia majora.

Condylomata lata are flat, slightly infiltrated papules with superficially degenerating and desquamating epithelium. They are usually found simultaneously on the labia majora, perineum and around the anus. In exceptional cases they are very much infiltrated and superficially ulcerated as a result of mechanical irritation; or they may coalesce to form large plaques or patches. To confirm the diagnosis the entire body must be examined for syphilis.

Late forms of syphilis produce gummata and the resulting serpiginous ulcers with grayish, ragged floors; they are very rare.

During the first and second stages the diagnosis presents no difficulties; ulcers that result from broken-down gummata during the later stages may be mistaken for carcinoma or tuberculosis. In doubtful cases the therapeutic test should not be employed until after carcinoma has been positively excluded. A positive diagnosis can be made with the microscope. The finding of spirochæta pallida appears to be a positive diagnostic sign of lues.

3. The **tuberculous ulcer** has sharp and sometimes undermined edges; it is flat, and cicatrization often occurs on one side only. Small tubercle nodules are often found on the floor of the ulcer and in the surrounding tissue; there is no marked infiltration. The ulcer may develop anywhere on the vulva. In connection with glandular ulcers polypoid proliferations of the tuberculous mucous membrane occasionally occur.

CASE 28. The inner surface of the left labium minus is the seat of an ulcer with ragged edges and lardaceous, bacony floor; the surrounding mucous membrane is red, infiltrated and covered with small ulcers the size of a millet seed. The floor of the ulcer contains the beginning of a fistula, which terminates in the anterior surface of the rectum in front of the posterior commissure. Microscopic examination of an excised piece of tissue reveals giant cells and tubercle bacilli.

The term lupus vulvae is limited to that form of tuberculosis of the vulva which consists in multiple nodules and, by breaking down of the nodules, leads to the formation of ulcers and extensive cicatrization.

The diagnosis of tuberculous ulcer is simplified by the fact that it is practically never primary and represents a secondary localization

in genital or pulmonary tuberculosis. A search for other foci must therefore be made. All doubt may be removed by excising the base of the ulcer and finding tuberculous tissue and bacilli.

4. **Rodent ulcer** (ulcus rodens, s. chronicum, s. elephantiasticum) is an ulceration accompanying hypertrophic conditions of the skin. The ulcer spreads along the surface and, by involving deeper portions of the tissue, produces perforations and fistulæ in the urethra, labia and perineum.

The pathologic status of these ulcerations is still in doubt, as the tissue merely shows inflammatory changes without specific elements of any kind in uncomplicated cases. Its specific nature must be denied. There is a certain connection with syphilis inasmuch as old lues predisposes to the condition. Tuberculosis apparently develops secondarily in the ulcers at times. The true cause is usually found in stasis of the lymph circulation (after extirpation or suppuration of the inguinal glands), and injuries of various kinds acting upon the ill-nourished tissue.

Well-developed ulcers have a very characteristic appearance. They are found in the fossa navicularis, on the lesser labia and clitoris, and usually represent flat ulcerations with sharp, eroded, often deeply undermined edges. If they extend downward, perforations of the lesser labia and deep cavities in the perineum are produced, from which fistulæ are given off that go still deeper, often as far as the rectum. The ulcers are bright red in color, smooth and shining, and in some places covered with exudate; they often have a pronounced serpiginous character. While one edge heals by cicatrization, the ulceration advances on the other side. The ulcer is accordingly surrounded by radiating scars, which may produce ectropion of the urethra and vulva. The tissues immediately surrounding the ulceration are rigid, but there is rarely any brawny infiltration. These ulcerations are frequently associated with forms of elephantiasis as described on page 383, and the combination of neoplasm and degeneration may produce a very complicated clinical picture.

The anal skin takes part in the process with the production of hypertrophic folds surrounding the orifice, and shallow ulcerations. Cicatricial strictures and ulcerations are found in the rectum.

In view of the above findings the diagnosis of rodent ulcer is in the main easy. Carcinomatous ulcer is distinguished chiefly by the hard infiltration of its edges and floor and of the surroundings parts. Tuberculous ulceration may produce signs so similar that the true nature of the process can be recognized only with the microscope by demonstrating the bacilli. With regard to the distinction from syphilitic processes, we should adopt the standpoint that rodent ulcer is prone to develop on the foundation of syphilitic tissue-predisposition, but does not itself represent a syphilitic tissue disease.

Microscopic Diagnosis of Malignant Diseases of the Uterus, Vagina and Vulva.

In accordance with the meaning of the word 'malignant' the microscopic diagnosis of malignant diseases of the uterus includes all those affections which do not subside spontaneously, which continue to spread without limit, and for the removal of which special medical procedures are necessary. The success of medical interference depends on early removal of the malignant focus. If it has existed long, or an expectant policy is pursued, radical removal, which is always to be aimed at, may be impossible. The indication for intervention at the earliest possible moment depends on an early diagnosis. As a number of malignant diseases cannot at first be recognized clinically, and many benign changes in the beginning sometimes appear clinically to be malignant, the microscope must decide the diagnosis in such cases. The nature of the tissue seen in the microscopic specimen shows whether the alteration is inflammatory or malignant. If there is any doubt whether the degeneration is malignant or benign, a piece should be excised, or the uterus curetted for the purpose of microscopic examination, as the latter will determine whether a malignant or a non-malignant disease is present.

Necessity of Early Diagnosis.

General Portion.

The number of diseases which require microscopic examination to determine malignancy are not many. They include first of all carcinoma, and with it adenocarcinoma and malignant adenoma, sarcoma, and endothelioma; and finally malignant syncytioma and chorionepithelioma. Malignant diseases are recognized by certain changes and proliferations of cellular constituents. A number of malignant changes, such as tuberculosis and actinomycosis, are definitely identified by the presence of the causal microörganisms.

To begin with, the microscopic diagnosis of carcinoma—the early recognition of malignant tissue—is based solely and alone on the architectural picture—the histologic structure. Carcinoma is a malignant neoplasm of very definite histologic composition, and a very small particle of the tumor often suffices for a positive microscopic diagnosis. We must take into account the spurious pictures (artefacts) which make trouble

The Microscopic Diagnosis of Carcinoma is Based on the Architecture of the Tumor.

for the inexperienced and which will be described in detail, and also the situation from which the pieces to be examined have been obtained. As there are physiologic prototypes for the cellular structures of malignant tumors (for example, the decidual cell is the physiologic prototype of the sarcoma cell), so there are physiologic or benign types of tissue which resemble the structure of malignant neoplasms. The neoplasms differ in their appearance according to the place from which they are derived. The erroneous opinions prevailing in regard to so-called 'diagnoses based on small pieces' must be attributed either to want of skill on the part of the examiner, or the failure to distinguish between the significance of definition and that of the structural picture. The definition of carcinoma takes account of its origin, emphasizes the local destruction, the atypical mode of spreading (infection of the surrounding tissues), its extension in the more remote tissues, the formation of metastases, and the destruction of the individual by cachexia. In addition, it includes a description of recurrence, of the etiology, and of the histologic composition. In the definition of cancer the entire life history of the malignant neoplasm is sketched. In the study of the microscopic picture, on the other hand, we have to deal solely with the earliest stage of the disease; there is no question of metastases and of extension to the neighborhood. The structural picture of carcinoma does not in the least depend on whether or not the tumor has broken through its boundaries; cancer is not recognized either by muscle tissue or by liver cells. If the specimen contains liver cells, all that can be concluded is that the cancer is a liver cancer. We recognize cancer by its structure, and our experience tells us that the neoplasm is at first local, and later gradually destroys the individual's life. The importance of the architecture must be especially emphasized. The pathologist who is familiar with the architecture is able to diagnose cancer, while he who has only mastered the definition of cancer is not thereby enabled to recognize anything. Recognition of the cancer leads to the microscopic diagnosis, and after the diagnosis has been made, it is possible to give a definition; but the definition itself has its limitations (for example, in regard to heterotopia), just as the architecture by itself may be deceptive.

Physiologic Prototypes of Malignant Neoplasms.

Definition and Structural Picture.

According to the definition, cancer is a malignant, epithelial neoplasm of atypical growth which, while primarily local, spreads by excessive, unlimited proliferation, causes local destruction, oversteps the tissue boundaries (heteroplasia), slowly spreads to adjoining, and later to more remote parts, either directly or by way of the vessels (lymphatics, blood-vessels), and produces metastases in distant portions of the body (heteroplasia). The latter, depending on the vital importance of the regions in which they develop, either slowly or rapidly produce a functional disturbance, and finally the cancerous infection brings about the death of the individual from exhaustion (cancerous cachexia). The epithelium is derived from the epi-

Definition of Carcinoma.

thelium originally present at the site of the cancer. With regard to the etiology, all that is known is that traumatism may produce carcinoma, and that there are certain seats of predilection indicating a 'weakness' in the composition of the predisposed region; the inference that cancer occasionally develops in such localities cannot always be demonstrated or recognized. Heredity plays an insignificant part. The character of the epithelium at the various periods of life (in connection with the character of the body-tissues in the immediate and more remote neighborhood) is of great importance even if it cannot be directly seen, stained or represented. The bacterial origin of cancer has as yet never been demonstrated. The theory that carcinoma is an infectious disease, either according to the older view of dyscrasia, or according to the more modern conception of a disease caused by specific microörganisms, has never been proved. Two things, however, are absolutely certain: First, that cellular proliferations and neoplasms develop without the action of any causal microörganisms; and second, that there are infectious tumors in the causation of which bacteria play an important part. If an agent of which we know nothing should ever be demonstrated, and not merely assumed as the cause of cancer, it would not alter the fact that the diagnosis rests on the structure; although it is possible that some therapeutic advantage might be derived from such a discovery.

Etiology of Carcinoma.

It is important to remember, for other reasons as well as for the value of a diagnosis based on small pieces of tissue, that the definition starts out with the assumption of a primarily local origin; this assumption at once disposes of the objection which has been made repeatedly that extension of the cancer to the surrounding tissue cannot be seen in the microscopic specimen. It is quite true that we cannot see this extension of the cancer; we only infer that it takes place from what we see in the tissues surrounding the malignant proliferation, or we may say that we know by previous experience that the cancer will continue to grow. There are cancers that have not advanced beyond the boundaries of the mucous membrane; for example, there are polypoid proliferations in which only cancerous degeneration is demonstrable, and which are separated from the organ by layers of normal tissue; in such cases the carcinoma can be radically removed by simple erasion. The important thing is to recognize the cancer early, and this in turn depends on the ability to recognize the architecture. The latter may be summed up briefly as follows: newly formed alveolar spaces not previously present in the tissue and filled or lined with an epithelial mass (alveolar or glandular carcinoma). The tissue, the normal composition of which is known, is invaded by masses of epithelial elements, which may be large or small, broad or narrow. This leads to the production of vacuoles, clefts, tubular canals, which again communicate with one another and are completely, or almost completely filled with epithelial masses. The epithelial masses grow into the tissue and produce alveolar spaces, and at the same time fill them up.

Cancer is Primarily Circumscribed.

Architecture of Carcinoma: Alveolar Spaces in Part or Wholly Filled with Epithelial Cells.

If the proliferation of the carcinomatous masses is to be compared to the wood-worm, or burrowing worm, which burrows and forms canals in wood and destroys it, it must be added in the case of carcinoma that the destruction takes place not only at the extremity

occupied by the worm, but the entire system of canals occupied by the proliferating epithelial masses is the seat of proliferation. At any point of the alveolar spaces which are filled with the epithelial masses a fresh burrow may originate and extend into the neighboring tissue,—an atypical, resistless creeping onward. In the schematic picture below the arrows indicate this slow advance, and at the same time the proliferation that takes place at every point (Fig. 219). The more recent stages are usually the narrowest, while the beginning proliferations—the oldest stages—are the broadest. There is a difference between the transverse and the longitudinal section; in the latter the communicating, canal-like passages are seen, while in the transverse section the epithelial strands produce circular or oval, flattened pictures of different sizes. It should be emphasized that the tissue which the carcinoma invades as a destructive neoplasm, at the same time constantly producing fresh carcinomatous tissue, is quite different from the neoplastic, destroying epithelial masses. The tissue may be in a state of great irritation and become the seat of small-celled infiltration; the deeply stained, small round cells may, like the decidual cells in decidual endometritis, cover up the epithelial masses, particularly if the latter still represent slender, almost fibrous columns of cells (epithelial cords, carcinomatous nodes). The greater the tenuity of the invading epithelial masses, the more easily will the picture of epithelial infiltration—of cellular flooding—be produced. In

Fig. 219.—Illustrating the Method by Which the Carcinoma Spreads to the Surrounding Tissue. (Original.)

superficially beginning carcinomata the small-celled infiltration may produce the picture of a reaction zone or productive zone toward the sound tissue; or the tissue may show no signs whatever of the invasion; the cancer nests of solid epithelial cords are simply embedded in an apparently intact tissue. Imagine the epithelial masses removed, wipe them out with a brush artificially in a microscopic preparation or remove them by maceration, and you will see in the tissue the vacuoles, the longitudinal and transverse sections and the system of canals,—in short, the alveolar structure into which the tissue has been converted by the epithelial masses.

Carcinomatous proliferations beginning on the surface (derived from surface epithelium) may retain their connection with the latter (Fig. 220). Often the superficial layer is destroyed or desquamates. Shortly before the appearance of the carcinoma all but the lowest layer of cells, which is difficult to recognize, not infrequently scales off from the stratified epithelium like varnish. If a typical reaction zone develops between the epithelium, which is apparently desquamating (Fig. 221) and in process of disintegration, and the beginning carcinoma, there is apparently nothing to show that the carcinoma originates in the epithelium. The carcinoma, beginning in small delicate epithelial cords, extends downward to the tissues. At first this can be demonstrated only with the microscope, but later the whitish or whitish-yellow epithelial cords can be seen with the naked eye. The large cellular masses are recognized on the cut surface with the naked eye, and can be expressed like comedones. Although a microscope with a magnification of three and a half to ten diameters is necessary for purposes of confirmation, the eye should nevertheless be trained to make the diagnosis without any magnification, or at least with the aid only of a very low power lens.

carcinomatous elements are epithelial in origin and in ... requires some practice to recognize them as such. In ... cancer nests and in situations where the growth is slow the individual elements can often be distinguished by their contour, particularly in the case of older elements situated near the centre; while younger cells tend to undergo ... spheroidal extension. Within the zone of proliferation it is difficult ... often impossible to recognize the elements directly, because they ... so small and delicate that their contours apparently fuse with one another. Strands of cancer tissue are also encountered that are filled solid with epithelial masses and in which no cell contours at all are visible, the round, and often quite uniform nuclei are packed closely

Fig. 109.—The Carcinoma Originates in the Already Existing Stratified Squamous Epithelium and Sends down Plugs into the Deeper Layers. (Original.)

together; the cellular material is rolled into a ball and compressed so that it appears like a mass of cells without any individual units. The cellular material—the cancer nests or cancer cords—is sharply separated from the tissue, and sometimes by its stain even from the stroma. If the tissue is the seat of small-celled infiltration, the stroma is darker than the epithelial cords; and conversely, if the stroma or supportive tissue contains but little small-celled infiltration, the stroma is paler. The boundaries between epithelial proliferation and stroma are always sharply defined, even when, owing to marked epithelial proliferations with many nuclei and small-celled infiltrations in the tissue, the line of division between the two tissues is difficult to see.

Cancer is Sharply Separated from Surrounding Tissue.

Carcinoma is an epithelial, malignant neoplasm, with no ... to spontaneous recovery, an atypical and unlimited growth of

distinct alveolar structure, the alveolar spaces being filled with epithelial masses. The epithelium is derived from the previously existing epithelium (portio vaginalis), or from cylindrical epithelium (cervix, body).

In carcinoma originating in squamous epithelium the original epithelium either remains unaltered and forms the starting-point of the malignant neoplasm, or it undergoes a change previous to and along with the beginning of malignant proliferation; in that case the epithelial neoplasm begins in altered epithelium. Stratified squamous epithelium may become cylindrical, and conversely, cylindrical epithelium may become stratified; hence carcinomatous epithelial cords appear in a great variety of different forms, from thick solid epithelial plugs to proliferations covered with a single layer of cylindrical epithelium. The same cancer node may contain various modifications—metaplasiæ, transitional forms between squamous and cylindrical epithelium, and *vice versa*. The originally separated epithelial cords, after proliferating for a short time independently, may fuse and form large conglomerations. Secondary degeneration the result of breakdown or mucous change may occur.

Fig. 221.—The Squamous Epithelium of the Vaginal Portion scales off like varnish. The cancer plugs begin at some distance from the squamous epithelium without any apparent connection with it. (Original.)

The architecture of the carcinoma varies according to the seat of its origin. The latter may often be determined by the nature of the structure; thus a certain composition observed in carcinomatous masses obtained by curettage—metastases, for example—may be so characteristic that the presence of carcinoma of the ovary may be inferred.

The polymorphous nature of a malignant adenoma for a long time, and even at the present day, prevented its being recognized even by good authorities as a carcinoma of peculiar structure.

The carcinomatous proliferations beginning in stratified squamous epithelium give rise to the production of thin, narrow cell cords (Figs. 220 and 222). The cells may be so closely packed that the contours disappear or become very indistinct; or, as in the case of large cancer nests, the peripheral elements which are most concerned in the proliferative process may be difficult to identify in the preparation; while at the centre, where the process is older, large cells with distinct outlines are seen. Sometimes the closely packed cells loosen up and appear like desquamated cells. In the microscopic picture the central portions appear softened, and in the stained specimen the nuclei are irregular in size and intensely stained, while in the peripheral layers they are fairly uniform. This simple process of loosening in the central portions must be distinguished from direct degeneration, in which the cells break down, the nuclei become paler, and the chromatin disappears. In the interior of cancerous alveoli of this kind a mucoid, fatty or finely granular mass is seen. A peculiar necrosis of the cells may also take place at the centre. The cells in that case, instead of as usual losing their staining properties, appear to be rolled up in a ball and in exceptional cases stain intensely, forming either a dark red or a violet mass in the centre, depending on the stain that is used (Fig. 223). The solid epithelial plugs which originate in the squamous epithelium, develop a glandular character as

Carcinoma Beginning in Stratified Squamous Epithelium.

Central Softening in Solid Cancer Plugs.

the result of this central degeneration. Cancers derived from stratified squamous epithelium also produce pictures similar to those seen in cancroid of the skin: epithelial pearly bodies are arranged in layers like the skins of an onion (Fig. 224); but changes of this kind are not very common in carcinoma of the vaginal portion, though relatively frequent in the body (see p. 397). The cancer cords are usually round or oval and flattened, sharp pointed or indented edges being found as a rule only when the carcinoma spreads along the lymph clefts, a mode of extension to which, in contradistinction to the others, the term "worm-eaten" is applied. This form of extension is often directly continuous as solid cell-cords, the endothelium of the lymph vessels being often preserved (Fig. 225). These simple epithelial masses which extend slowly in the lymph-clefts must be distinguished from the changes which begin directly in the endothelial lining

Cancroid Formation.

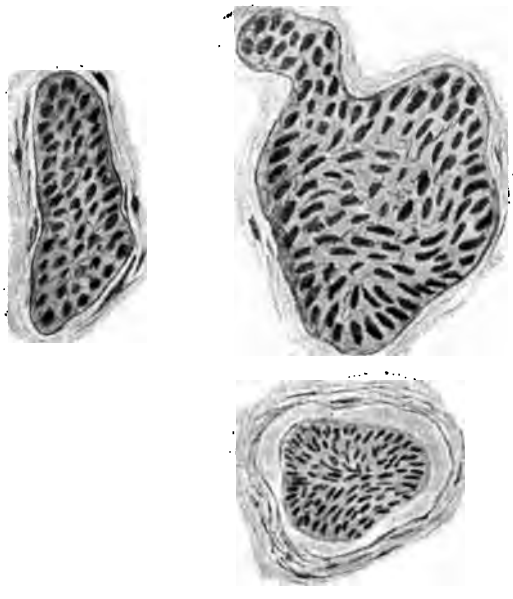

FIG. 222.—SOLID CANCER PLUGS of various shapes: 1. Simple; 2. With beginning processes; 3. A cancer node separated from the stroma by 'maceration'; the 'alveolar' space is especially well shown. (Original.)

FIG. 223.—CANCER PLUG suggesting a gland, with a central lumen containing a necrotic mass (secondarily glandular). (Original).

of the lymphatics (endothelioma verum). The carcinomata that spread in the lymph channels are solid, but may become hollow, developing a loose structure in the central portion.

With regard to the shape of carcinomata beginning in cylindrical epithelium, we must distinguish (1) the behavior of the cervical epithelium and (2) that of the corporeal.

1. As a rule, the single layer of cylindrical epithelium of the cervix is converted into stratified epithelium. At the same time the original inequalities of the cervical mucous membrane are smoothed out. The epithelial masses appear uniform in composition, both at the surface and in the deeper layers, without distinct cellular outlines. These masses give off thick, solid plugs that penetrate into the deeper layers (Fig. 226); the epithelial cords are often large enough to be seen with the unaided eye and represent gigantic, somewhat shapeless round or cord-like structures, 1 mm. broad and several millimetres long; rarely they contain a few cervical mucous glands. Along with the alteration in the surface epithelium a malignant proliferation begins, as it were, in the nascent state. In the place of solid epithelial cords, or along with such cords, large epithelial structures with a central cavity, which occupies the structure uniformly, are seen, giving the plugs the appearance of a glandular structure (Fig. 227). The conversion

Conversion into Stratified Epithelium: (*a*) Solid Cell-cords.

of the cylindrical epithelium in the cervical glands progresses uniformly and *pari passu* with a considerable peripheral multiplication; but no solid plugs or cords are produced. In addition to the seprimarily glandular forms in which the stratification of the cylindrical epithelium does not produce solid plugs, the picture of the glandular form may develop secondarily by degeneration of the central masses (Fig. 223). This central necrotic mass may take the stain so intensely that the nodes are distinctly seen in the epithelial plugs, which are visible to the unaided eye. As the central metamorphosis increases, the central lumen may become larger, while the stratified parietal layer continues to proliferate and maintains a fairly uniform thickness. This results in central breakdown and peripheral boundless proliferation. Myxomatous changes may also

(b) Primarily Glandular Form.

FIG. 224.—CANCEROUS PLUG, containing several epithelial pearly bodies (onions). Cancroidal form of cancer. (Original.)

FIG. 225.—A SOLID ALVEOLAR CANCER. Directly continuous with the further proliferation of the growth in the lymph-clefts (carcinoma lymphoides). (Original.)

take place in the large cancerous epithelial cords. The lumina are filled with mucoid masses, with here and there fatty granule cells, and the stroma is reduced to a few scanty layers of cells (Fig. 228). This produces the appearance of confluent, somewhat irregular ovula Nabothi; the earlier stages of cellular proliferation in the form of slowly advancing solid epithelial cords which have become larger and exhibit mucoid degeneration at the centre, are also present. Partial 'recovery' takes place in these cases along with the slow advance of the most recent stages.

(c) Secondarily Glandular Form

In contrast to these epithelial, not to say gigantic proliferations, there should be mentioned the rare forms in which the entire tissue of the cervix looks as if it had been eaten through, and the microscopic section to the unaided eye shows practically nothing at all. The tissue is filled with gland-like formations, separated by uniform intervals, but nevertheless interdigitating, and becoming invaginated or evaginated, withdrawing and then again approaching one another without actual contact. Under low power the tissue appears to be filled with strands of glandular tissue of fairly uniform width, while the individual strands are separated by a uniformly wide stroma. Under higher power it is distinctly seen that

the single layer of cylindrical epithelium has been replaced by a uniform stratification of one to three rows (Fig. 229). In other cases the cylindrical structure is preserved (stratified cylindrical epithelium). This alteration represents the carcinoma which is designated malignant adenoma of the cervix (Fig. 230).

Irregular Cancerous Metamorphosis of Glands.

Whereas the changes that result from carcinomatous metamorphosis in the cervical epithelium and other epithelial structures are uniform—in so far as proliferation repeats itself uniformly in the structures—an irregular architecture is also occasionally observed. Large portions of the glandular structures undergo carcinomatous degeneration; the lumen of the gland becomes greatly dilated and lined with stratified epithelial masses, which do not, however, extend over the entire gland; part of the latter is preserved (Fig. 231) and seems to form an appendix to the stratified carcinomatous epithelial alterations above. The epithelium preserves its cervical character, and in this way the picture of adenoid or glandular cervical carcinoma is produced. Similar pictures are encountered in the healing of erosions and in epidermidalization. In this form of carcinoma the gland is found but little altered on one side, while at the other pole the carcinoma continues to advance. The carcinomatous degeneration may begin in the surface epithelium or in deeper layers of the mucous membrane, and the pictures vary accordingly.

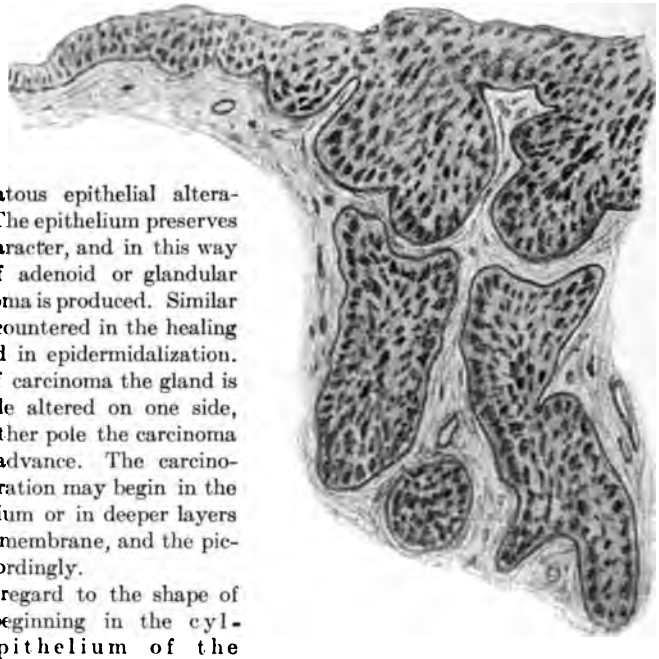

FIG. 226.—THE CYLINDRICAL EPITHELIUM which has been converted into stratified epithelium grows into the deeper tissues in the form of solid cancer plugs. (Original.)

2. With regard to the shape of carcinomata beginning in the cylindrical epithelium of the body, in the previously existing surface epithelium, or in the uterine glands, it must be emphasized that the carcinoma usually begins in the surface, as in the case of cervical cancer, but may also originate in the deeper tissues underneath an intact mucous membrane. The cylindrical epithelium of the body may be converted into a thick, stratified layer, as already described in connection with the cervix (Fig. 226). It gives off thick epithelial plugs which penetrate into the deeper layers; the uterine glands disappear, or rarely may be preserved (carcinoma alveolare) alongside of the thick cellular plugs, which now continue their resistless advance. The entire surface of the uterus may be covered with thick, epithelial layers of this kind and, owing to the shallow depressions of the surface which correspond to the uterine glands, it may macroscopically resemble the surface of the decidua vera with its dilated gland lumina. In contrast to the delicate, pinkish surface of the normal uterus covered with cylindrical epithelium, the surface becomes somewhat rigid from the presence of the thick, epithelial masses; the color is whitish, resembling icing on a cake, or the surface of a frozen pond. This icing, to adopt a descrip-

2. Carcinoma Beginning in the Cylindrical Epithelium of the Body.

Conversion into Stratified Epithelium (Icing-cancer).

-m, may cover the entire surface, or it may be limited to the lower portion near the

internal os. Occasionally isolated psoriatic patches are seen. The stratified epithelium often peels off and is elevated from its foundation in the form of a tongue (Fig. 232). It may be compared to a stream of lava flowing over the surface and apparently only covering the uterine glands. One gets the impression that the epithelial masses have overflowed from a more deeply situated cervical carcinoma (corporeal and cervical carcinomata are often found in combination) (carcinoma with icing-like changes of the surface epithelium).

In addition to this conversion of the cylindrical epithelium into a strati-

FIG. 227.—CANCER PLUG OF PRIMARILY GLANDULAR STRUCTURE. (Original.)

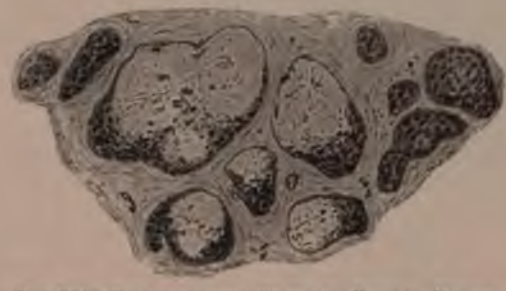

FIG. 228.—CARCINOMA IN A STATE OF PARTIAL MYXOMATOUS (MUCOID) DEGENERATION. (Original.)

fied epithelial mass, formations are observed which in every respect resemble cancroid of the skin. Everywhere an abundant, onion-like proliferation (cancroid) is seen. This form may occasionally grow with tremendous rapidity, and the cancroid pearly bodies (horny cancer) may be found in the smallest, thinnest epithelial proliferations in the deepest portions of the tissue (Fig. 233).

In addition to this conversion into a firm, massive, stratified epithelial layer, there may be observed a metamorphosis of the surface or of the parietal epithelium going on hand in

FIG. 229.—THE CYLINDRICAL EPITHELIUM IS CONVERTED INTO STRATIFIED EPITHELIUM consisting of two or three rows of cells, and remains everywhere uniform. (Original.)

FIG. 230.—THE CYLINDRICAL EPITHELIUM IS CONVERTED INTO STRATIFIED EPITHELIUM, consisting of two or three rows, and in the main retains its cylindrical shape. (Original.)

hand with a more marked peripheral (centrifugal) growth; these proliferating masses do not fill the lumen, but remain parietal and thus produce a glandular structure. The individual elements in cancer of the body may (1) retain their more delicate appearance, as compared with the cells seen in cancer of the vaginal portion and of the cervix; the protoplasm is finely granular and stains faintly. Or (2) the parietal proliferation may be much more irregular and less uniform; along with slight or absent stratification there may be found papillary accumulations of cells which may project far into the dilated lumen of the gland and finally unite with similar outgrowths from the other side. In this way constrictions and divisions are formed in these epithelial proliferations which finally produce the picture

of fenestration (Fig. 234). To these forms, which occur frequently in uterine, and rarely in cervical cancer or cancer of the vaginal portion, the descriptive term carcinoma glandulare fenestratum may be applied. Another change that takes place in the uterine epithelium may be likened to a ribbon with an open-work lace edging (Fig. 235). The proliferation is irregular; in one place small papillary elevations adjoining larger ones which do not, however, exceed a certain height—about ten cells. The picture, which is more distinct in longitudinal sections, is at first papillary; the epithelial points become connected with one another, and an edging of epithelium containing gaps or alveoli is produced along the wall. This variety of cancer has received the descriptive name of carcinoma glandulare papillare alveolare. It is to be remembered that this epithelial process which takes place in the lumina of the original glands is accompanied by numerous proliferations at the periphery, causing a ten- to twelve-fold enlargement of the original lumen. The membrana propria of the gland, which is at first preserved even in malignant proliferations, is finally destroyed. The presence of a membrana propria is not even against the malignant nature of the epithelial process going on in the interior of the gland. It may be destroyed when the proliferation is benign and, conversely, may survive for some time after malignant degeneration has set in. It is not only important, but interesting as well to learn the different forms which carcinoma—malignant epithelial formation—assumes in different portions of the organ. There are some cancer forms that are seen almost exclusively in the body; others practically only in the cervix; and still others that are confined to the vaginal portion. Mention should also be made of a form of cancer in which the metaplasia of the cylindrical epithelium into squamous epithelium is particularly marked, although in the above-described varieties the epithelium in the main loses its cylindrical character; nevertheless, the proliferating cylindrical epithelium still suggests its original shape—an impression which is enhanced by the finely granular protoplasm, and the faint tingibility. In this carcinomatous change, which is termed metaplasia, the cylindrical epithelium of the uterine gland is not converted into compact, stratified epithelial masses, but into elements which strictly resemble squamous epithelium. They are either piled up in the regular fashion and form papillary excrescences; or proliferations of squamous epithelium are produced, the upper layers undergoing cornification (Fig. 236) with the production of 'horns' (cornua cutanea)—formations resembling corns—with enormous enlargement of the glands. During the first stage this carcinomatous, atypical epithelial proliferation, which breaks through all bounds, resembles benign epithelial changes; it suggests the proliferations of the Gebhard-Opitz glands (the glands of pregnancy). The latter, which in a sense represent the physiologic prototype of carcinoma, have been often mistaken for malignant degeneration.

Ribbon Cancer a Subvariety of the Fenestrated Type.

FIG. 231.—THE CYLINDRICAL EPITHELIUM IS CONVERTED INTO STRATIFIED EPITHELIUM, but continues nevertheless to proliferate in a solid mass, while a part of the gland, lined with cylindrical epithelium, is preserved. (Original.)

Cornification in the Converted Epithelium.

While the above-described malignant stratifications appear firm, coherent and compact, alterations which present the picture of distinct metaplasia are more loosely joined together and seem to desquamate. Metaplasia of the corporeal cylindrical epithelium into squamous epithelium, with subsequent proliferation of the latter, occasionally occurs in the deepest portions of the mucous membrane, the muscularis, and in the epithelial structures which have penetrated into it; in this situation it is undoubtedly autochthonous. Cancerous alteration of the corporeal mucous membrane, known as malignant adenoma, has a peculiar significance and represents a glandular cancer (carcinoma

glandulare, adenoides, adenocarcinoma) which has a characteristic architecture. Whereas in carcinomatous epithelium there is an enormous peripheral proliferation, the corporeal cylindrical epithelium, on the other hand, develops stratification —the epithelium is piled up. In malignant adenoma the peripheral proliferations are distinctly seen—enormous, boundless epithelial proliferation into the surrounding structures; the stroma is destroyed and the epithelium advances slowly but steadily, producing metastases; but no stratification and no piling up of the elements occur as in the usual picture of carcinoma. The cells proliferate side by side, following the type of physiologic growth. Malignant adenomata possess only one layer of cells; they retain the character of a simple 'glandular' structure. For a long time observers failed to recognize this because the peculiar malignant form of proliferation was mistaken for a benign process, and the mistake is sometimes made to this day. It is true that the epithelium in malignant adenoma may differ materially from that seen in benign proliferations, and the

Malignant Adenoma is a Horizontal (Side by Side) Malignant Proliferation of Epithelium.

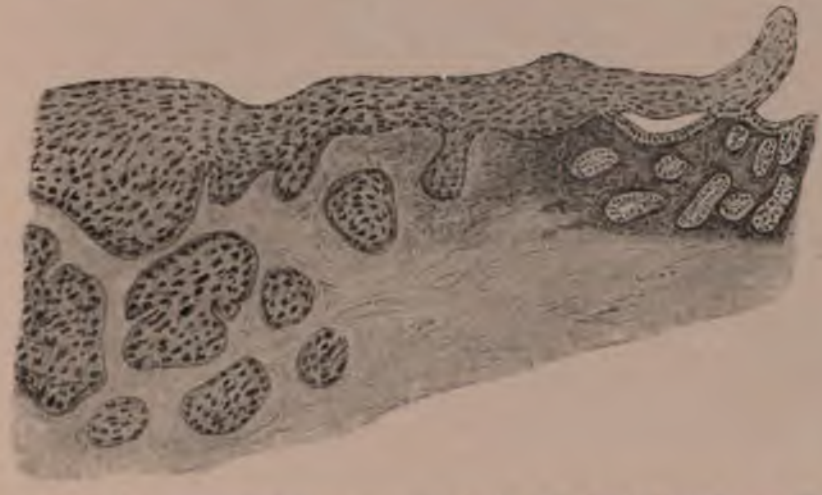

FIG. 232.—THE STRATIFIED SQUAMOUS EPITHELIUM COVERS THE MUCOUS MEMBRANE OF THE BODY AND SENDS DOWN SOLID PLUGS (CANCER NODES) INTO THE DEEPER TISSUES. At one end the stratified epithelium apparently peels off (icing-cancer). (Original.)

appearance alone, the peculiar diffuse staining properties, the size of the nuclei and their individual differences suffice to indicate malignancy; nevertheless the individual elements are not sufficiently characteristic to form the basis of a positive diagnosis. The change in the epithelium does no more than indicate the possibility that a malignant degeneration may be present. In addition to the peculiar change in the protoplasm and in the nuclei, there is also noticed an arrangement in two layers, due to the rapid growth of the elements and their spreading to make room for one another—a process which can also occur in non-malignant proliferations (Fig. 237). While in malignant adenomata of the corporeal mucous membrane the changes in the cell protoplasm and in the nuclei alone hardly suffice to predicate the beginning of malignancy, in the case of malignant adenomata of the cervical epithelium and of the vaginal portion, which begin in the glandular epithelium of erosions and are both much more rare, the change from the originally cervical character is exceedingly suspicious, not to say decisive. Cervical or erosion-epithelium that stains diffusely and with a washed-out effect, and thus comes to resemble corporeal epithelium, suggests beginning malignancy and demands the closest scrutiny.

Malignant adenoma, like alveolar and glandular cancer, is recognized by its architecture. It is a glandular cancer with the epithelium arranged in a single row, like a simple glandular formation. There is no specific difference between carcinomata that vary in their

the result of this central degeneration. Cancers derived from stratified squamous epithelium also produce pictures similar to those seen in cancroid of the skin: epithelial pearly bodies are arranged in layers like the skins of an onion (Fig. 224); but changes of this kind are not very common in carcinoma of the vaginal portion, though relatively frequent in the body (see p. 397). The cancer cords are usually round or oval and flattened, sharp pointed or indented edges being found as a rule only when the carcinoma spreads along the lymph clefts, a mode of extension to which, in contradistinction to the others, the term "worm-eaten" is applied. This form of extension is often directly continuous as solid cell-cords, the endothelium of the lymph vessels being often preserved (Fig. 225). These simple epithelial masses which extend slowly in the lymph-clefts must be distinguished from the changes which begin directly in the endothelial lining

Cancroid Formation.

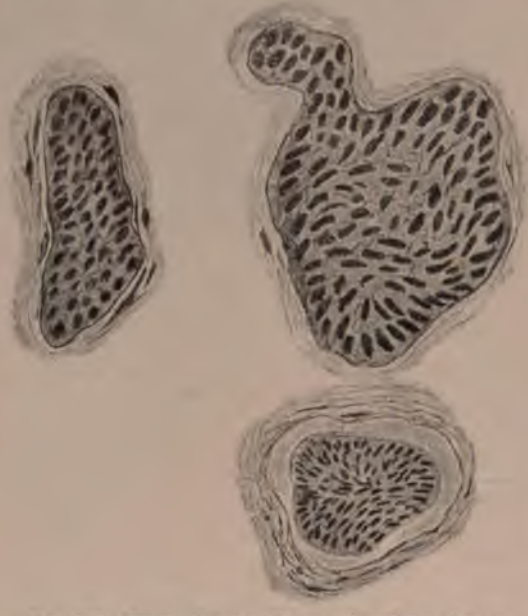

FIG. 222.—SOLID CANCER PLUGS of various shapes: 1. Simple; 2. With beginning processes; 3. A cancer node separated from the stroma by 'maceration'; the 'alveolar' space is especially well shown. (Original.)

FIG. 223.—CANCER PLUG suggesting a gland, with a central lumen containing a necrotic mass (secondarily glandular). (Original).

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1. As a rule, the single layer of cylindrical epithelium of the cervix is converted into stratified epithelium. At the same time the original inequalities of the cervical mucous membrane are smoothed out. The epithelial masses appear uniform in composition, both at the surface and in the deeper layers, without distinct cellular outlines. These masses give off thick, solid plugs that penetrate into the deeper layers (Fig. 226); the epithelial cords are often large enough to be seen with the unaided eye and represent gigantic, somewhat shapeless round or cord-like structures, 1 mm. broad and several millimetres long; rarely they contain a few cervical mucous glands. Along with the alteration in the surface epithelium a malignant proliferation begins, as it were, in the nascent state. In the place of solid epithelial cords, or along with such cords, large epithelial structures with a central cavity, which occupies the structure uniformly, are seen, giving the plugs the appearance of a glandular structure (Fig. 227). The conversion

Conversion into Stratified Epithelium: (*a*) Solid Cell-cords.

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(*b*) Primarily Glandular Form.

FIG. 224.—CANCEROUS PLUG, containing several epithelial pearly bodies (onions). Cancroidal form of cancer. (Original.)

FIG. 225.—A SOLID ALVEOLAR CANCER. Directly continuous with the further proliferation of the growth in the lymph-clefts (carcinoma lymphoides). (Original.)

take place in the large cancerous epithelial cords. The lumina are filled with mucoid masses, with here and there fatty granule cells, and the stroma is reduced to a few scanty layers of cells (Fig. 228). This produces the appearance of confluent, somewhat irregular ovula Nabothi; the earlier stages of cellular proliferation in the form of slowly advancing solid epithelial cords which have become larger and exhibit mucoid degeneration at the centre, are also present. Partial 'recovery' takes place in these cases along with the slow advance of the most recent stages.

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In contrast to these epithelial, not to say gigantic proliferations, there should be mentioned the rare forms in which the entire tissue of the cervix looks as if it had been eaten through, and the microscopic section to the unaided eye shows practically nothing at all. The tissue is filled with gland-like formations, separated by uniform intervals, but nevertheless interdigitating, and becoming invaginated or evaginated, withdrawing and then again approaching one another without actual contact. Under low power the tissue appears to be filled with strands of glandular tissue of fairly uniform width, while the individual strands are separated by a uniformly wide stroma. Under higher power it is distinctly seen that

sions (erosion-glands), which may penetrate into the tissue of the vaginal portion. The erosion displaces the stratified surface epithelium of the portio vaginalis. As the involvement of the tissue of the portio

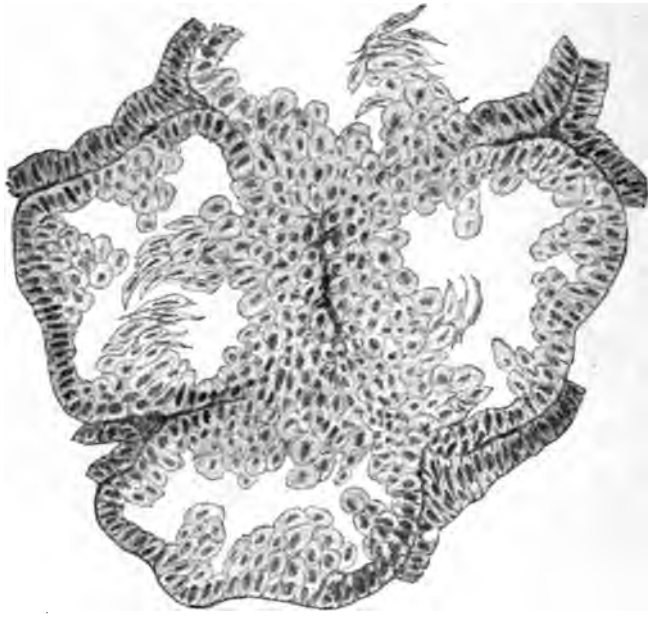


FIG. 236.—SEVERAL ADJACENT GLANDS have undergone partial cancerous change. The cylindrical epithelium in some places is converted into stratified squamous epithelium, or cornified epithelium. The glands coalesce; some of the glands are still normal. (Original.)

vaginalis becomes greater, the epithelium proliferates also on the surface and a papillary erosion is produced. Constrictions, secondary changes in the erosion-glands, and the retention of secretion lead to the production of 'follicular' erosion. The large occluded cysts which often occupy the deeper layers or form a protuberance on the surface, giving it an irregular appearance, have been designated ovula Nabothi.

FIG. 237.—THE RAPID AND VIGOROUS GROWTH of the epithelial cells leads to an apparent arrangement in two layers, due to 'spreading' of the upper portions of the cells. (Original.)

Carcinomatous degeneration may begin in any one of these forms —erosio-simplex, papillaris or follicularis (ovulum Nabothi). The glandular epithelium of the gland becomes stratified and proliferates, both peripherally and downward, breaking through all bounds. The carcinoma beginning in an erosion may retain its glandular character (Fig. 238), although the glandular wall is covered by stratified, instead of simple epithelium; sometimes erosion-glands that are only in part carcinomatous are found (comp. Fig. 227). If the stratification becomes excessive, the epithelial masses may produce solid plugs.

Ovula Nabothi, which are usually round, oval, or flattened from mutual pressure, lined with simple cylindrical epithelium, or cells shortened by the stretching or by cuboidal elements, may, in addition to simple stratification, show another modification—before the carcinomatous change begins, the epithelium forms fresh papillary or ridge-like proliferations. In cancerous change the epithelial plugs which originally fill the ovula Nabothi appear to be fixed by connective tissue sprouts, growing out of the original wall, and derived from the papillæ or the ridges (comp. Fig. 238, *a*). Carcinomatous degeneration may occur in the deeper layers, while the superficial tissue still appears to be benign. As a rule, however, the malignant process begins at the surface.

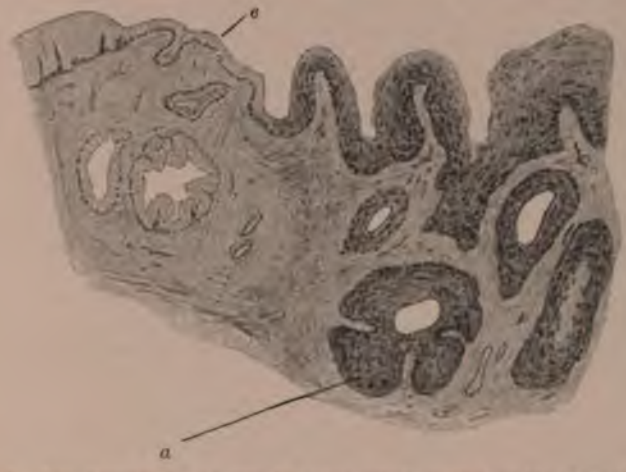


FIG. 238.—THE EPITHELIUM OF THE EROSIONS which develop at the vaginal portion is converted (*e*) into stratified epithelium and penetrates into the tissue like glands; at (*a*) is a follicle (ovulum Nabothi) which has become carcinomatous (erosion-carcinoma). (Original.)

The third form of cancer of the vaginal portion might be described as a sub-variety of the other two, were it not for the peculiar behavior of the epithelial proliferation. This is the malignant adenoma of the vaginal portion. Instead of the stratified squamous epithelium of this region there appears, first, cylindrical epithelium with a cervical character—pale, badly staining cell-body with basal nucleus; in other words, an erosion is produced. Next, the proliferation of the tissue leads to the formation of papillary erosions, and when the malignant degeneration begins the epithelium assumes the character of the corporeal cells—it stains diffusely and the nucleus is displaced. This metamorphosis of the cervical epithelium with loss of its characteristic properties is, as has been stated, a very suspicious process. The malignant degeneration then progresses as described above in connection with the histogenesis of malignant adenoma. The epithelium does not become stratified;

Malignant Adenoma of the Vaginal Portion.

[illegible]

[illegible]

[illegible] malignant [illegible] of the vagina [illegible] shows little tendency to penetrate [illegible] and [illegible] [illegible] a different form of glandular [illegible] [illegible] which [illegible] [illegible] change in the surface, [illegible] [illegible] [illegible] [illegible] and often show an external [illegible] [illegible]. The epithelium [illegible] a [illegible] structure, alternating with simple [illegible], [illegible] and deeply staining. The swellings [illegible] [illegible] [illegible]. Fig. 141 shows a picture of this form of [illegible] of the vaginal portion; [illegible] a striking regularity in the architecture of the [illegible]. It is often impossible to make a differential [illegible] [illegible] [illegible] the ability to make a prognosis and to apply suitable treatment depends. A waiting policy for the purpose of observation, however, may be fatal. If the [illegible] layer is extensive erosion, soft to the touch, [illegible] [illegible], or—on the other hand—an irregular [illegible] and vaginal portion, due to the formation of deep fissures, may appear suspicious. Under these circumstances, the diagnosis must be made by a [illegible] examination of an excised piece, i.e., by the [illegible] method. Erosions are recognized by their typical cervical epithelium—high, badly staining cells with basal nuclei in follicular ovula Nabothi [illegible], [illegible], and owing to the [illegible] of the [illegible], often very low. There are [illegible] [illegible] of the vaginal portion in which the arrangement in a single row of [illegible] and the epithelium at the same time retains its purely cervical character.

[illegible] may give rise to great diagnostic difficulties, particularly when there are [illegible] symptoms, such as hemorrhage and discharge. Cauterization also may [illegible] a very [illegible] appearance. The diagnosis is based on the fact that the microscopic [illegible] are made up of small-celled material. Ulcers, in addition, show marked proliferation of the vessels, which, with their thin walls, are close to the surface of the ulcer and rupture at the slightest touch or during movement of the part; often there is no recognizable or imaginable cause for their [illegible]. It is difficult, not to say impossible, to identify a syphilitic ulcer by the microscopic picture. All that can be done is to decide between benign and malignant. No reports are as yet available in regard to the spirochæte pallida in ulcerations of the cervix. Tuberculous ulcers may be identified by finding tubercle bacilli; in practice, however, a positive diagnosis is very difficult. In regard to the diagnostic value of giant cells, see the description and illustrations of these in tuberculous endometritis. Under these circumstances also, the main problem is to decide between malignant and benign degeneration. Pressure ulcers, due to the use of pessaries, may arouse a suspicion of carcinoma in prolapse, and in the presence of decubital ulcers at the vaginal portion. The diagnosis may be made by excising a piece and submitting it to a histologic examination. In addition to true ulceration of the vaginal portion, so-called erosion-ulcers may result from

intense inflammatory infiltration of a simple erosion, or from improper treatment of various kinds. The suspicion of carcinoma is dispelled by finding a small-celled infiltration and erosion-glands, and by the absence of epithelial new-formation. Small myomata or fibromata (fibromyomata) occasionally have to be examined under the microscope in order to exclude malignancy. Papillomata, nodular, irregular proliferations, racemose formations, cauliflower growths, which appear suspicious and are therefore removed, also occur in the vaginal portion. A careful examination should be made after the operation as, in the first place, the microscopic picture may determine whether the growth is a carcinoma, a sarcoma, or a carcinosarcoma; and, in the second place, whether the incision has been carried into sound tissue. The question of carcinoma is decided entirely by the histologic picture. In sarcoma the malignant changes are found within the connective tissue and stroma. Sarcoma is a malignant neoplasm of connective tissue, and the simple stroma elements may gradually be converted into large, excessively hypertrophied cells. Very much enlarged, deeply staining, round or irregular nuclei

Erosion-ulcers of the Vaginal Portion.

Papilloma of the Vaginal Portion.

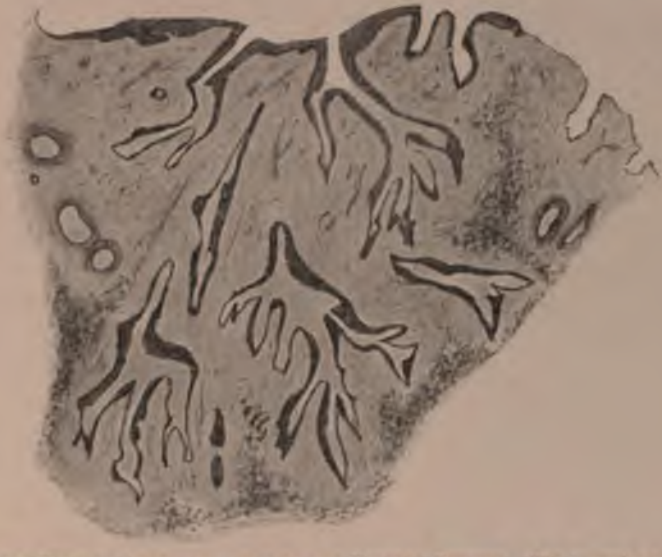


Fig. 240.—Peculiar Form of Adenocarcinoma of the Vaginal Portion. The irregular proliferation of the epithelium gives an angular appearance to the picture. (Original.)

point to sarcomatous degeneration. In the microscopic picture the irregularity of the excessively enlarged stroma elements is also noticeable. In addition to sarcomatous degeneration, glandular structures may occur in the neoplasm and exhibit malignant degeneration; this combination is called carcinosarcoma (Fig. 241). The microscopic composition, and hence also the diagnosis, is important, inasmuch as the prognosis in sarcomatous degeneration of the vaginal portion is more grave than that of carcinoma, although the operation may have appeared to be radical. There are rare cases of sarcoma of the vaginal portion which show a kind of node-formation (circumscribed round nodes); the sarcoma in these cases is usually a small-celled, round-celled sarcoma.

Sarcoma of the Vaginal Portion.

When the differential diagnosis presents difficulties, it is necessary for the examining physician to resort to the microscope for confirmation of the diagnosis. The histologic composition decides between malignancy and non-malignancy.

Certain difficulties with which the diagnosis occasionally has to contend in the microscopic picture remain to be mentioned. A knowledge of these pictures, which simulate carcinoma, and constant practice will enable the examiner to overcome these difficulties. Since there are physiologic prototypes of carcinoma, it is important to know from what situation the material to be examined has been obtained. At the vaginal portion the most important condition in this respect is the healing process of an erosion—so-called epidermidalization. Aside from this, the pictures of verrucose proliferations (warts, condylomata) must be reckoned with. With regard to the microscopic picture of the healing process in an erosion, the cylindrical epithelium which in erosions covers the surface instead of the original stratified squamous epithelium and lines the erosion-glands, is gradually converted back again into stratified epithelium—at first there are two or three layers of cylindrical and cuboidal cells, then the elements become more flat, until the thickness of the surrounding epithelial layer is attained. A similar metamorphosis takes place in the epithelium of the erosion-glands. The conversion of the simple cylindrical into stratified epithelium leads to the production of solid epithelial plugs. These gradually separate and become smaller, until finally they are no thicker than the surrounding epithelium. In this way complete healing of the erosion takes place. The plugs formed by the stratification of the epithelium may, in longitudinal sections, easily be mistaken for the beginnings of an epithelial malignant depression, whereas they merely represent the final stage in the reparative process. In one case it is a simple conversion with regeneration; in the other, a gradual, boundless proliferation. In flat cross-sections the erosion-glands may appear as solid epithelial masses. Epithelial nests lying in a corresponding gap in the tissue (in the alveolus) simulate the picture of carcinoma. Aside from the irregular grouping of the epithelium in carcinoma, and the variation in the size of the atypical nucleus,

Carcinosarcoma of the Vaginal Portion: Difficulties Presented by the Microscopic Picture.

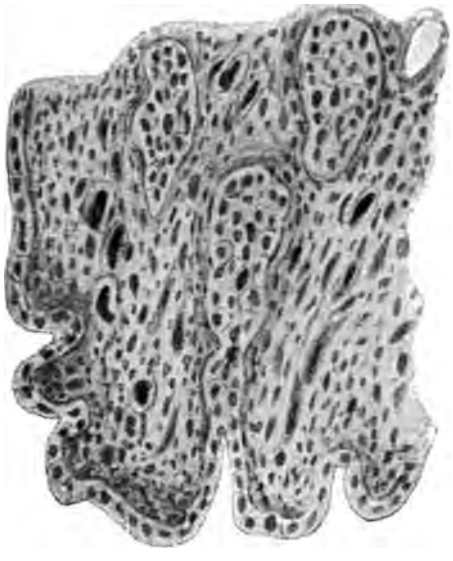


FIG. 241.—PAPILLOMA OF THE VAGINAL PORTION. The surface epithelium is cuboidal, the stroma contains large excessively hypertrophied cells with large nuclei; the glands show carcinomatous degeneration (carcinosarcoma). (Original.)

Epidermidalization Simulating Cancer.

it is necessary to demonstrate that the epithelial masses are penetrating into the deeper tissues. At first the diagnosis may have to be reserved. The important point is not to mistake the solid epithelial plugs which occur in the healing of erosions for carcinomatous changes.

Healing of Erosions.

In addition to complete healing of an erosion (sanatio completa), there is an incomplete healing (sanatio incompleta), in which the erosion-glands remain behind in the deeper layers, underneath the squamous epithelium of the vaginal portion, which has regained its normal character. These glandular remains are lined with beautiful cylindrical epithelium of the cervical type which have become cystic or follicular (ovula Nabothi) as the result of retention of the secretions. Stratification of the cylindrical epithelium lining the deep erosion-glands, which exhibit an antler-formation and may extend one centimeter below the surface, does not progress beyond a certain limit in the healing of an erosion. It may be assumed that in the vaginal portion (a different process is observed in polypoid proliferations) the reparative stratification does not extend much more deeply than the thickness of the normal epithelium. At this level stratification in the deep erosion-glands ceases; the part of the gland above that level is filled with stratified epithelium, and this solid part separates so that the surface again becomes uniform. The lower portion of the erosion-gland is apparently torn away and remains in the tissue, at first drawn out at its upper extremity and pinched off, and later becoming rounded. The picture of healing erosion-glands, particularly in sanatio incompleta, may in every respect resemble the picture of cancerous change in erosion-glands. Unless it can be demonstrated that the gland is still progressing downward, the decision between beginning carcinoma and the healing process may be impossible; under these circumstances also, it is important not to diagnosticate carcinoma if the picture is merely that of the reparative process.

The process of so-called epidermidalization is in every respect analogous to the healing process observed in erosions. The microscopic pictures are the same. It is merely a difference in the name applied to the metamorphosis of the surface, which in this case is originally covered with cylindrical epithelium, or rather of the epithelial invagination of the surface. These processes are observed chiefly in ectropion of the cervical mucous membrane (compare also polypi) and in the metamorphosis of cylindrical into stratified squamous epithelium which occurs in the developmental processes of the fetal parts. In ectropion the cylindrical is converted into stratified squamous epithelium. The cervical mucous membrane, which is at first pinkish with a slightly moist sheen, becomes whitish, firm and like epiderm.

Epidermidalization of the Surface which is Covered with Cylindrical Epithelium.

The gradual metamorphosis of the cylindrical epithelium, which originally lines the entire genital tract and at the end of embryonal life occasionally survives on the outer surface of the vaginal portion of new-born infants—where it is known as congenital erosion (comp. Fig. 63, *a* and *b*)—is an analogous process. Wherever the cylindrical epithelium is present, the vaginal portion appears pinkish with a moist sheen, like an erosion in adults, or like the appearance of cervical mucous membrane. In new-born infants, if the conversion of the cylindrical epithelium is not complete (congenital erosion), the surface is slightly papillary and the shallow depressions are later obliterated by stratification. Congenital erosion is an incomplete development; as a rule, the stratified squamous epithelium extends as far as the external os, or even into the cervical canal. The microscopic picture of a healing erosion—that is to say, the healing of a pathologic condition, the picture of ectropion in which the cervical mucous membrane assumes the character of epiderm, the picture of the conversion of cylindrical epithelium into stratified squamous epithelium in embryonal life—is everywhere the same; only the designation is different, depending on what condition is to be described.

Congenital Erosion.

So far we have spoken only of the danger of mistaking the picture of the healing processes of erosions for the picture of carcinoma. An important question is whether the erosions themselves are not to be regarded as carcinomatous. In the study of the genesis of erosion it is interesting to point out the importance of becoming familiar with, and thereby recognizing, the changes occurring in certain definite situations. In studying erosions we encounter alterations that are not malignant, contrary to the definition of carcinoma. If every atypical proliferation that begins in epithelium and, without respecting the tissue boundaries, penetrates into the adjoining tissues (heterotopia, heteroplasia) were carcinomatous, then erosions would be malignant proliferations. Erosion is a new-formation; cylindrical epithelium takes the place of the original stratified squamous epithelium; this cylindrical epithelium is often the starting-point of considerable proliferation as regards horizontal and vertical extension—the proliferated epithelial structures in the deeper layers of the tissues occasionally give rise to fresh proliferations, which cause considerable destruction of tissue. In spite of the fact that an erosion represents an epithelial new-formation, it is not malignant; but it may become malignant. The differential diagnosis must be made by the epithelium. So long as the epithelium of the erosion-glands retains its peculiar cervical type, malignancy can be excluded. A similar atypical new-formation of epithelium which does not respect the boundaries of the mucous membrane and which is in no sense malignant, will be discussed in connection with the uterine mucous membrane (see below).

Is Erosion a Malignant Proliferation?

Verrucose Proliferations. Condylomata.—The process in verrucose excrescences consists in proliferation of the papillary body of the investing stratified squamous epithelium. There may be various etiologic factors. In the microscopic picture, besides the increase in the stroma of the papillæ, a considerable increase of the investing epithelial layer is observed. If the papillary tissue exhibits a dendritic structure, and if a thick epithelial layer occupies the recesses of the papillæ, there is produced, especially in oblique, flat, and transverse sections, a picture of epithelial proliferation which may simulate that of beginning carcinoma of the vaginal portion. The investing epithelial

FIG. 242.—THE CERVICAL EPITHELIUM IS CONVERTED INTO STRATIFIED EPITHELIUM. The carcinomatous glands are greatly dilated and proliferate into the deeper layers (adenocarcinoma). (Original.)

layer at the base of the verrucose proliferation is usually not thicker than the surrounding epithelium, and occasionally dips down somewhat more deeply. By cutting the sections perpendicular to the surface, these proliferations of the epithelium and of the papillary body can always be recognized as superficial proliferations of the epiderm by the fact that they do not extend below a certain level, equivalent to the thickness of the ordinary squamous epithelium. Carcinoma of the vaginal portion, therefore, manifests itself in three different forms: 1. Simple alveolar cancer, including as a sub-variety, cancroid. 2. Erosion-carcinoma (glandular cancer). 3. Malignant adenoma, to which may be added a rare form of adenocarcinoma, with irregular swelling of the epithelium.

Carcinoma of the Vaginal Portion in the Microscopic Picture Appears in Three Different Forms.

Carcinoma of the cervix, like the preceding, exhibits various forms in the microscopic picture. 1. The simplest is that in which

everywhere the cells are arranged in single layers with proliferation of the stroma. The picture seen in the speculum may be that of a papillary erosion; as the process goes on, papillary proliferation appears in the vaginal portion, first in the neighborhood of the external os. In the microscopic picture the cell-cords are closely packed and interlacing, like a collection of earth-worms (Fig. 239). Malignant adenoma of the vaginal portion is rare; it rapidly infects the upper layers of the surrounding tissue and involves the vagina.

While malignant adenoma of the vaginal portion at first shows little tendency to penetrate downward, and extends more on the surface, which it infects; a different form of glandular cancer is occasionally observed in which, without any special change in the surface, glandular structures penetrate the deeper portions of the stroma and often show an external resemblance to erosion-glands. The epithelium, however, is variable, stratified, alternating with simple cuboidal, flattened, and deeply staining, like swellings in various pathologic conditions. Fig. 240 shows a picture of this form of adenocarcinoma of the vaginal portion; there is something angular in the architecture of the preparation. It is often impossible to make a differential diagnosis, on which the ability to make a prognosis and to apply suitable treatment depends. A waiting policy for the purpose of observation, however, may be fatal. To the palpating finger an extensive erosion, soft to the touch, or a slightly bleeding ulceration, or—on the other hand—an irregular nodular, hard, vaginal portion (due to the formation of deep follicles) may appear suspicious. Under these circumstances, the diagnosis must be made by a microscopic examination of an excised piece, *i.e.*, by the histologic composition. Erosions are recognized by their typical 'cervical' epithelium—high, badly staining cells with basal nuclei; in follicular ovula Nabothi the epithelium is cuboidal and, owing to the distention of the cysts, often very low. There are no malignant neoplasms of the vaginal portion in which the arrangement in a single row of cells predominates and the epithelium at the same time retains its purely cervical character.

FIG. 239.—CONVERSION OF PAPILLARY EROSION INTO A MALIGNANT ADENOMA (resembling a collection of (earth-worms). (Original.)

Ulcerations may give rise to great diagnostic difficulties, particularly when there are suspicious clinical symptoms, such as hemorrhage and discharge. Cauterization also may produce a very suspicious appearance. The diagnosis is based on the fact that the microscopic picture is made up of small-celled material. Ulcers, in addition, show marked proliferation of the vessels, which, with their thin walls, are close to the surface of the ulcer and rupture at the slightest touch or during movement of the part; often there is no recognizable or imaginable cause for their production. It is difficult, not to say impossible, to identify a syphilitic ulcer by the microscopic picture. All that can be done is to decide between benign and malignant. No reports are as yet available in regard to the spirochæte pallida in ulcerations of the cervix. Tuberculous ulcers may be identified by finding tubercle bacilli; in practice, however, a positive diagnosis is very difficult. In regard to the diagnostic value of giant cells, see the description and illustrations of ulcers in tuberculous endometritis. Under these circumstances also, the main problem is to decide between malignant and benign degeneration. Pressure ulcers, due to the use of pessaries, may arouse a suspicion of carcinoma in prolapse, and in the presence of decubital ulcers at the vaginal portion. The diagnosis may be made by excising a piece and submitting it to a histologic examination. In addition to true ulceration of the vaginal portion, so-called erosion-ulcers may result from

Ulcerations on the Vaginal Portion.

Syphilitic Ulcer.

Tuberculous Ulcer.

intense inflammatory infiltration of a simple erosion, or from improper treatment of various kinds. The suspicion of carcinoma is dispelled by finding a small-celled infiltration and erosion-glands, and by the absence of epithelial new-formation. Small myomata or fibromata (fibromyomata) occasionally have to be examined under the microscope in order to exclude malignancy. Papillomata, nodular, irregular proliferations, racemose formations, cauliflower growths, which appear suspicious and are therefore removed, also occur in the vaginal portion. A careful examination should be made after the operation as, in the first place, the microscopic picture may determine whether the growth is a carcinoma, a sarcoma, or a carcinosarcoma; and, in the second place, whether the incision has been carried into sound tissue. The question of carcinoma is decided entirely by the histologic picture. In sarcoma the malignant changes are found within the connective tissue and stroma. Sarcoma is a malignant neoplasm of connective tissue, and the simple stroma elements may gradually be converted into large, excessively hypertrophied cells. Very much enlarged, deeply staining, round or irregular nuclei

Erosion-ulcers of the Vaginal Portion.

Papilloma of the Vaginal Portion.

FIG. 240.—PECULIAR FORM OF ADENOCARCINOMA OF THE VAGINAL PORTION. The irregular proliferation of the epithelium gives an angular appearance to the picture. (Original.)

point to sarcomatous degeneration. In the microscopic picture the irregularity of the excessively enlarged stroma elements is also noticeable. In addition to sarcomatous degeneration, glandular structures may occur in the neoplasm and exhibit malignant degeneration; this combination is called carcinosarcoma (Fig. 241). The microscopic composition, and hence also the diagnosis, is important, inasmuch as the prognosis in sarcomatous degeneration of the vaginal portion is more grave than that of carcinoma, although the operation may have appeared to be radical. There are rare cases of sarcoma of the vaginal portion which show a kind of node-formation (circumscribed round nodes); the sarcoma in these cases is usually a small-celled, round-celled sarcoma.

Sarcoma of the Vaginal Portion.

When the differential diagnosis presents difficulties, it is necessary for the examining physician to resort to the microscope for confirmation of the diagnosis. The histologic composition decides between malignancy and non-malignancy.

Certain difficulties with which the diagnosis occasionally has to contend in the microscopic picture remain to be mentioned. A knowledge of these pictures, which simulate carcinoma, and constant practice will enable the examiner to overcome these difficulties. Since there are physiologic prototypes of carcinoma, it is important to know from what situation the material to be examined has been obtained. At the vaginal portion the most important condition in this respect is the healing process of an erosion—so-called epidermidalization. Aside from this, the pictures of verrucose proliferations (warts, condylomata) must be reckoned with. With regard to the microscopic picture of the healing process in an erosion, the cylindrical epithelium which in erosions covers the surface instead of the original stratified squamous epithelium and lines the erosion-glands, is gradually converted back again into stratified epithelium—at first there are two or three layers of cylindrical and cuboidal cells, then the elements become more flat, until the thickness of the surrounding epithelial layer is attained. A similar metamorphosis takes place in the epithelium of the erosion-glands. The conversion of the simple cylindrical into stratified epithelium leads to the production of solid epithelial plugs. These gradually separate and become smaller, until finally they are no thicker than the surrounding epithelium. In this way complete healing of the erosion takes place. The plugs formed by the stratification of the epithelium may, in longitudinal sections, easily be mistaken for the beginnings of an epithelial malignant depression, whereas they merely represent the final stage in the reparative process. In one case it is a simple conversion with regeneration; in the other, a gradual, boundless proliferation. In flat cross-sections the erosion-glands may appear as solid epithelial masses. Epithelial nests lying in a corresponding gap in the tissue (in the alveolus) simulate the picture of carcinoma. Aside from the irregular grouping of the epithelium in carcinoma, and the variation in the size of the atypical nucleus,

Carcinosarcoma of the Vaginal Portion: Difficulties Presented by the Microscopic Picture.

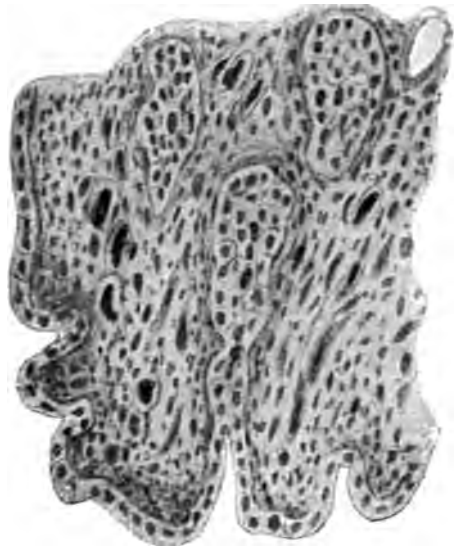


FIG. 241.—PAPILLOMA OF THE VAGINAL PORTION. The surface epithelium is cuboidal, the stroma contains large excessively hypertrophied cells with large nuclei; the glands show carcinomatous degeneration (carcinosarcoma). (Original.)

Epidermidalization Simulating Cancer.

it is necessary to demonstrate that the epithelial masses are penetrating into the deeper tissues. At first the diagnosis may have to be reserved. The important point is not to mistake the solid epithelial plugs which occur in the healing of erosions for carcinomatous changes.

Healing of Erosions.

In addition to complete healing of an erosion (sanatio completa), there is an incomplete healing (sanatio incompleta), in which the erosion-glands remain behind in the deeper layers, underneath the squamous epithelium of the vaginal portion, which has regained its normal character. These glandular remains are lined with beautiful cylindrical epithelium of the cervical type which have become cystic or follicular (ovula Nabothi) as the result of retention of the secretions. Stratification of the cylindrical epithelium lining the deep erosion-glands, which exhibit an antler-formation and may extend one centimeter below the surface, does not progress beyond a certain limit in the healing of an erosion. It may be assumed that in the vaginal portion (a different process is observed in polypoid proliferations) the reparative stratification does not extend much more deeply than the thickness of the normal epithelium. At this level stratification in the deep erosion-glands ceases; the part of the gland above that level is filled with stratified epithelium, and this solid part separates so that the surface again becomes uniform. The lower portion of the erosion-gland is apparently torn away and remains in the tissue, at first drawn out at its upper extremity and pinched off, and later becoming rounded. The picture of healing erosion-glands, particularly in sanatio incompleta, may in every respect resemble the picture of cancerous change in erosion-glands. Unless it can be demonstrated that the gland is still progressing downward, the decision between beginning carcinoma and the healing process may be impossible; under these circumstances also, it is important not to diagnosticate carcinoma if the picture is merely that of the reparative process.

The process of so-called epidermidalization is in every respect analogous to the healing process observed in erosions. The microscopic pictures are the same. It is merely a difference in the name applied to the metamorphosis of the surface, which in this case is originally covered with cylindrical epithelium, or rather of the epithelial invagination of the surface. These processes are observed chiefly in ectropion of the cervical mucous membrane (compare also polypi) and in the metamorphosis of cylindrical into stratified squamous epithelium which occurs in the developmental processes of the fetal parts. In ectropion the cylindrical is converted into stratified squamous epithelium. The cervical mucous membrane, which is at first pinkish with a slightly moist sheen, becomes whitish, firm and like epiderm.

Epidermidalization of the Surface which is Covered with Cylindrical Epithelium.

The gradual metamorphosis of the cylindrical epithelium, which originally lines the entire genital tract and at the end of embryonal life occasionally survives on the outer surface of the vaginal portion of new-born infants—where it is known as congenital erosion (comp. Fig. 63, *a* and *b*)—is an analogous process. Wherever the cylindrical epithelium is present, the vaginal portion appears pinkish with a moist sheen, like an erosion in adults, or like the appearance of cervical mucous membrane. In new-born infants, if the conversion of the cylindrical epithelium is not complete (congenital erosion), the surface is slightly papillary and the shallow depressions are later obliterated by stratification.

Congenital Erosion.

Congenital erosion is an incomplete development; as a rule, the stratified squamous epithelium extends as far as the external os, or even into the cervical canal. The microscopic picture of a healing erosion—that is to say, the healing of a pathologic condition, the picture of ectropion in which the cervical mucous membrane assumes the character of epiderm, the picture of the conversion of cylindrical epithelium into stratified squamous epithelium in embryonal life—is everywhere the same; only the designation is different, depending on what condition is to be described.

So far we have spoken only of the danger of mistaking the picture of the healing processes of erosions for the picture of carcinoma. An important question is whether the erosions themselves are not to be regarded as carcinomatous. In the study of the genesis of erosion it is interesting to point out the importance of becoming familiar with, and thereby recognizing, the changes occurring in certain definite situations. In studying erosions we encounter alterations that are not malignant, contrary to the definition of carcinoma. If every atypical proliferation that begins in epithelium and, without respecting the tissue boundaries, penetrates into the adjoining tissues (heterotopia, heteroplasia) were carcinomatous, then erosions would be malignant proliferations. Erosion is a new-formation; cylindrical epithelium takes the place of the original stratified squamous epithelium; this cylindrical epithelium is often the starting-point of considerable proliferation as regards horizontal and vertical extension—the proliferated epithelial structures in the deeper layers of the tissues occasionally give rise to fresh proliferations, which cause considerable destruction of tissue. In spite of the fact that an erosion represents an epithelial new-formation, it is not malignant; but it may become malignant. The differential diagnosis must be made by the epithelium. So long as the epithelium of the erosion-glands retains its peculiar cervical type, malignancy can be excluded. A similar atypical new-formation of epithelium which does not respect the boundaries of the mucous membrane and which is in no sense malignant, will be discussed in connection with the uterine mucous membrane (see below).

Is Erosion a Malignant Proliferation?

Verrucose Proliferations. Condylomata.—The process in verrucose excrescences consists in proliferation of the papillary body of the investing stratified squamous epithelium. There may be various etiologic factors. In the microscopic picture, besides the increase in the stroma of the papillæ, a considerable increase of the investing epithelial layer is observed. If the papillary tissue exhibits a dendritic structure, and if a thick epithelial layer occupies the recesses of the papillæ, there is produced, especially in oblique, flat, and transverse sections, a picture of epithelial proliferation which may simulate that of beginning carcinoma of the vaginal portion. The investing epithelial

FIG. 242.—THE CERVICAL EPITHELIUM IS CONVERTED INTO STRATIFIED EPITHELIUM. The carcinomatous glands are greatly dilated and proliferate into the deeper layers (adenocarcinoma). (Original.)

layer at the base of the verrucose proliferation is usually not thicker than the surrounding epithelium, and occasionally dips down somewhat more deeply. By cutting the sections perpendicular to the surface, these proliferations of the epithelium and of the papillary body can always be recognized as superficial proliferations of the epiderm by the fact that they do not extend below a certain level, equivalent to the thickness of the ordinary squamous epithelium.

Carcinoma of the Vaginal Portion in the Microscopic Picture Appears in Three Different Forms.

Carcinoma of the vaginal portion, therefore, manifests itself in three different forms: 1. Simple alveolar cancer, including as a sub-variety, cancroid. 2. Erosion-carcinoma (glandular cancer). 3. Malignant adenoma, to which may be added a rare form of adenocarcinoma, with irregular swelling of the epithelium.

Carcinoma of the cervix, like the preceding, exhibits various forms in the microscopic picture. 1. The simplest is that in which

the cylindrical epithelium loses its original character and becomes stratified, in which the peripheral extension to the glandular structure is retained, and the parietal stratified epithelium represents a covering of variable size and thickness (Fig. 242). The central lumen, which gives the appearance of glandular structure, may occasionally disappear, and large solid aggregations or plugs of epithelium make their appearance. Carcinoma of the cervix may begin more in the deep layers of the mucous membrane, and comparatively normal mucous membrane may persist over the carcinoma. The descriptive terms employed for this variety are glandular and alveolar carcinoma.

Stratification in Carcinoma, the Glandular Structure being Retained: Adenocarcinoma. Conversion of the Epithelial Proliferation into Solid Cords (Alveolar Carcinoma).

2. The second form is that in which the surface epithelium is converted into a thick, stratified epithelial mass, which sends out broad, robust strands of epithelium into the tissue. These strands exhibit an enormous development as compared with other epithelial plugs or strands, and it is often impossible to see the entire strand in a microscopic field without moving the specimen. The form is still glandular; it is a peculiar gigantic growth (gigantism) (comp. Figs. 223 and 242). The cervical glands, which are at first preserved, at the same time undergo a similar change; sometimes, however, they apparently remain intact, as though forgotten among the giant glands. This form is designated by the descriptive term "icing-carcinoma" as, owing to the thick covering of epithelium, the surface looks like a cake covered with icing.

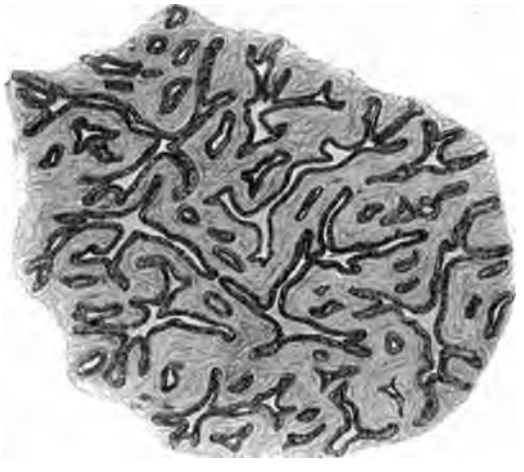


FIG. 243.—MALIGNANT ADENOMA OF THE CERVIX; everywhere simple cylindrical epithelium (worm-eaten carcinoma). (Original.)

3. Malignant adenoma is a third form. It differs, however, in a very important respect from malignant adenoma of the vaginal portion and of the body in that no new-formation is observed on the surface. The malignant structures traverse the tissue like glandular canals lined with a single layer of epithelium (Fig. 243), which no longer retains the pronounced cervical type, and may extend as far as the peritoneum. The glandular canals form enormous ramifications and retain a peculiarly regular arrangement, separated by approximately uniform

Carcinoma of the Cervix Takes the Form of Malignant Adenoma.

fields of stroma tissue. As in the case of lymph-carcinoma, the cervical tissue looks worm-eaten, like rotten wood; the curette can be carried with ease as far as the peritoneum and the malignant material scraped out.

A modification of malignant adenoma in which the epithelium presents a peculiarly uniform arrangement in two or three rows, instead of a single layer of cells, is observed more frequently than the above form. The cells may be cylindrical (Fig. 244) or approximately round (Fig. 245). This gives the picture an appearance which differs from that of the carcinomatous forms which are usually observed. The entire tissue of the cervix may be riddled by these cellular cords, and to the naked eye the cross-section may show very little change.

Fig. 244.—Malignant Adenoma of the Cervix; stratified cylindrical epithelium. (Original.)

Fig. 245.—Malignant Adenoma of the Cervix; uniformly stratified epithelium. (Original.)

4. The fourth variety follows the lymph channels, thereby assuming an irregular, retiform appearance, with minute intercommunicating clefts which here and there present considerable dilatation (comp. Fig. 225). The microscopic picture, as well as the macroscopic appearance and the impression produced by the scrapings, is that of worm-eaten, rotten tissue, which offers very little resistance to the curette. The term 'worm-eaten carcinoma,' while merely descriptive, is justifiable as it serves to distinguish this from other forms of cancer. Carcinoma occurring in the lymph channels may be independent or autochthonous, beginning immediately underneath apparently normal, or practically normal epithelium—the malignant

degeneration begins in the endothelium of the lymph vessels (endothelioma). Or lymph-carcinoma may be secondary and represent concomitant phenomena and neoplasms slowly spreading in the lymph channels and infecting the tissues. The latter form is distinguished from epithelium (see below) by the fact that the endothelium of the lymph vessels and of the lymph clefts is left intact, and takes no part in the cancerous process.

In cervical alterations, as in the case of changes observed in the vaginal portion, the examining physician resorts to microscopic examination if the differential diagnosis presents difficulties. The question of malignancy is decided by the histologic composition; again, the importance of the architecture must be emphasized.

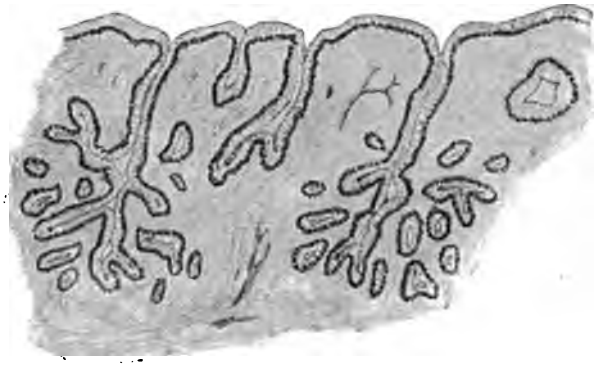


FIG. 246.—GLANDULAR HYPERPLASIA OF THE CERVIX; the epithelium is not altered, and the process is therefore still benign. (Original.)

With regard to the difficulties of interpreting the histologic picture, what has been said in connection with the vaginal portion applies to cervical alterations also.

The cylindrical epithelium of the surface may undergo epidermidalization in the presence of ectropion or polypoid proliferation. The histologic processes are the same as in the healing of erosions in the vaginal portion, and as in epidermidalization of congenital erosions. Verrucose formations, such as originate in the papillary bodies of the papillæ in the vaginal portion, are practically never observed in the cervix.—The differential diagnosis between the microscopic picture of lymph-carcinoma and that of endothelioma, will be discussed later.—Mention should be made of a peculiar glandular change that occurs in the cervix, and which occasionally suggests the beginning of an adenocarcinoma—a malignant adenoma of the mucous membrane. Here and there among the normal or slightly proliferated cervical glands a circumscribed proliferation of some of the glands is observed. The glandular trunk sends out fresh ramifications. If this proliferation takes place at

several points on the glandular trunk, the picture of racemose structure is produced (glandular hyperplasia of the cervix, Fig. 246). In the present state of our experience glandular proliferations of this kind may be regarded as benign or, at the most, as suspicious, so long as the distinctly cervical character of the epithelium is retained.

Carcinoma of the uterine body also appears in various forms. To begin with, the epithelium of the uterine glands undergoes magnification and stratification of a fairly regular kind. The cylindrical epithelium, as always during stratification, loses its original shape and becomes irregular. As a result of this stratification, solid epithelial structures (cancer nests) may be produced (alveolar carcinoma); or a more or less centrally situated lumen may be preserved, in which case the picture of glandular carcinoma (adenocarcinoma) is produced. As in other forms of carcinoma, the superficial layers may remain normal and the carcinoma may begin in the deeper layers. This form, in which the carcinoma begins below the surface by a gradual conversion and stratification of the originally cylindrical epithelium—the mucous membrane remaining entirely normal—is interesting in the study of the architecture of carcinoma, as well as, in a certain sense, in connection with the etiology. Here again it must be emphasized that the destruction of the membrana propria, which in the later stages is a matter of course, is by no means characteristic during the beginning stages of the cancer. Epithelial proliferations, and not the destruction of the membrana propria, betray the carcinomatous nature of the process; the membrana propria is destroyed in simple proliferation, particularly in necrobiotic processes of glands, and therefore proves nothing; or at least, is not in itself a proof of malignancy.

Carcinoma of the Body of the Uterus.

The Cylindrical Epithelium in Cancer of the Body Becomes Stratified (Alveolar Carcinoma), or Retains its Glandular Structure (Adenocarcinoma).

The second form is the icing-carcinoma (Fig. 232). Large portions of the corporeal mucous membrane—sometimes insular areas surrounded by apparently normal mucosa—or the entire surface, present even to the naked eye a different appearance on account of the whitish-gray, translucent (opaque) color, and the impression of rigidity, from that of the normal pink, velvety, delicate mucosa. In the microscopic picture the delicate, simple cylindrical epithelium is converted into a thick, stratified epithelial mass in which the individual elements cannot be recognized; these thick epithelial coverings send down epithelial plugs below the surface, which form robust proliferating masses throughout the corporeal tissue. The uterine glands usually disappear completely; rarely a few intact glands are seen among the carcinoma plugs. A noteworthy feature of the latter is that they show no carcinomatous change such

The Surface is Converted into 'Icing.'

as has been described; they apparently do not become involved in this form of cancer, and seemingly die a passive death. The thick epithelial mass on the surface appears peeled off at the edge, like a stream of lava; the epithelial mass is poured out on the surface and slowly rolls onward.

The third variety is the so-called horny cancer (cancroid of the uterine mucosa, Fig. 233). It resembles the two former by the fact that the epithelial proliferation also leads to the production of robust, apparently firm, solid cancer plugs, in contrast to the adenoid forms, which will be described later. The epithelial surface, which has been converted into a thick, solid epithelial mass, sends out solid plugs below the surface; everywhere, even in the smallest plugs, onion-like structures (epithelial pearly bodies, cancroid pearly bodies) are present. This form of cancer in every respect resembles that of cancroid of the external skin.

Carcinoma of the Body Takes the Form of a Horny Cancer.

In contrast to these three forms of cancer, we have a fourth variety in which the architecture is adenoid. The pictures in this form are more graceful in comparison with the more or less solid structure of the cancer plugs. Among adenoid cancers two forms of very different appearance are distinguished: (**a**) the simple glandular form (adenocarcinoma, adenocarcinoma fenestratum, carcinoma glandulare, Fig. 227); (**b**) the so-called malignant adenoma, which is separated from the other carcinomata and described by a different name on account of the peculiar arrangement of the cells, in one layer (Fig. 234). With regard to the first group (**a**), we may refer to what has been said in the beginning of the chapter. The epithelium of the uterine glands proliferates and the glands become enlarged and dilated, but the proliferation is not uniform in every part of the glandular lumen; papillary projections of varying lengths are produced, and may unite with similar projections, either of the same, or the opposite wall, producing alveoli or fenestræ in the epithelial mass,—the so-called fenestrated or ribbon-shaped cancers (Figs. 234 and 235). The newly-formed cells are more delicate, and the structure appears softer in comparison with the solid architecture of the first three forms. Great interest attaches to the pictures in which the carcinomatous metamorphosis occurs only in certain portions of the enlarged glands, leaving some parts of the glandular wall covered with apparently normal epithelium; in these pictures the change in the nuclei and in the tingibility between degenerated and not yet degenerated normal cells, is very conspicuous. These glandular changes, even in the glands below the surface in the muscularis, show very clearly the metaplasia of the original cylindrical epithelium (Fig. 236), along with the alteration of the nucleus and protoplasm; the cylindrical

Glandular Structure in Cancer of the Body.

cells become cuboidal and irregular, and are finally converted into squamous epithelium with cornification. In the lumen of the gland, the metaplastic cells look like epithelial horns of the external skin, like miniature cornua cutanea; accordingly, this variety of cancerous change exhibits not only proliferation, but also desquamation. The cancerous glands, which at first are still separated, approach one another by peripheral extension, and may become confluent. In these adenoid forms it is often impossible to distinguish any alveolar spaces; everything is cancerous, and it is difficult to find the characteristic cancerous change—the alveolar structure with the alveoli filled with epithelial proliferations. The expert pathologist will waste no time looking for alveolar structure; his knowledge of these alterations enables him to recognize the carcinoma directly.

Metaplasia of the Cylindrical Epithelium in Cancer of the Body.

With regard to (**b**)—adenoid carcinoma of the body or malignant adenoma—the name adenoma has been retained because the tumor frequently appears simply glandular, although not so in reality. This variety of cancer has often been mistaken for a simple adenomatous benign glandular proliferation, even by pathologists. Malignant adenoma is a carcinoma like those already described, but with a peculiar architecture; the epithelial cells proliferate side by side instead of in layers, with a change in the cell forms. As the proliferation is too great to be accommodated in a single plane, papillary, villous proliferations upward, downward, and to both sides, are seen in malignant adenoma. The epithelial cells may multiply to such an extent that the stroma which gives support to the epithelial proliferation cannot keep up, and the cells of the proliferated epithelial bands are arranged close together; the bases of the cells may even be in contact (the cells are *dos-à-dos*). The stroma occasionally consists of a single connective tissue cell and its processes. In cross-section these bands of proliferated epithelium appear like long papillæ (Fig. 255, *b*), covered with a single layer of cells. The picture is therefore not that of a 'gland' with the stroma outside and the cells in the interior (with the cells *vis-à-vis*); it merely has a general 'glandular' appearance.

Carcinoma of the Body in the Form of Malignant Adenoma.

When in speaking of malignant adenoma we say a single layer of epithelium, we mean that the layer of cells is actually single and almost of uniform height, although, as often happens in epithelial proliferations, an apparent double formation is produced by the fact that one cell has a very small base and the one next to it a broader one with a correspondingly thin upper extremity (Fig. 237). At any rate, the peculiarity of malignant adenoma of the body consists in a high degree of proliferation with only one layer of cells; nevertheless the

epithelium does not quite retain the shape and appearance of normal epithelium. Aside from the fact that the cells are often exceedingly narrow from mutual pressure, a change in the nuclei and in the protoplasm accompanies the cancerous change. The tingibility

FIG. 247.—SCHEMA I, *a:* GENESIS OF MALIGNANT ADENOMA OF THE BODY IN LONGITUDINAL SECTION; INVERTING FORM. (Original.)

also is somewhat different; the nucleus is longer, narrower, and the cell takes the stain in a peculiar, diffluent manner. The alteration is difficult to describe, but with a little practice it is very easily recognized. In contrast to normal epithelium the cells have a

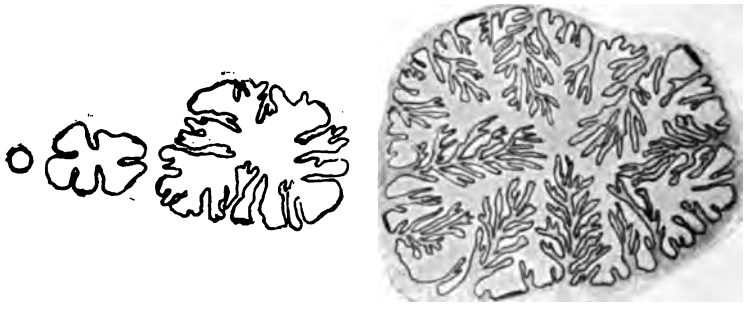


FIG. 248.—SCHEME I, *b:* GENESIS OF MALIGNANT ADENOMA OF THE BODY IN TRANSVERSE SECTION; INVERTING FORM. (Original.)

blurred, turbid appearance; the change cannot be seen so well in a single cell as in a whole row, and the architecture as a whole is peculiar. The original uterine gland in the degeneration of malignant adenoma is destroyed by the enormous epithelial proliferation which goes on in all directions. The proliferation may be in a single direction for a considerable distance, producing a peculiar uniform

appearance: cords of cylindrical epithelial cells are found side by side at uniform distances from one another; again the enormous epithelial proliferation may take place in various directions, every part of the epithelial cord becoming the starting point of a fresh proliferation, producing the greatest irregularity, the cell cords interlacing in every direction. Hence to the inexperienced observer the regular forms of malignant adenoma appear like an entirely different process from the irregular, tangled proliferations. In the latter, the picture resembles a tangled coil of earth-worms, while in the former the architecture is more regular and more glandular (gland by gland).

FIG. 249.—CROSS-SECTION FROM A MALIGNANT ADENOMA OF THE BODY; EVERTING FORM. The site of the original lumina of the glands can still be recognized. (Original.)

Familiarity with malignant adenoma may be acquired by studying the process of proliferation in various glands in schematic form. In Scheme I, *a* (Fig. 247), a normal gland is shown in longitudinal section. The small epithelial elevations in all parts of the gland gradually increase in size, becoming both longer and narrower, and in turn bring forth papillary elevations. As a result,

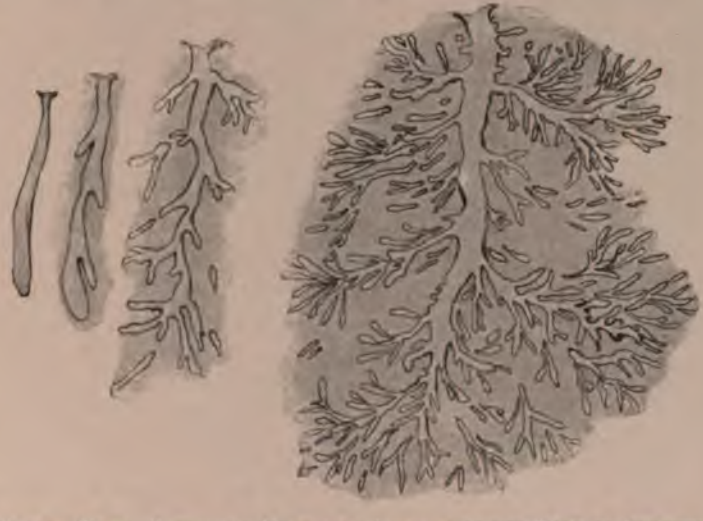


FIG. 250.—SCHEME II, *a*: GENESIS OF MALIGNANT ADENOMA OF THE BODY IN LONGITUDINAL SECTION; EVERTING FORM. (Original.)

the normal gland becomes considerably dilated and enlarged, and is converted into a mass of cell tubes by this intraglandular proliferation. There is no end to this form of malignant epithelial proliferation, which continues to destroy first the immediate neighborhood, then the more distant regions, then the entire organ, and finally by metastases and cachexia, the entire body. Scheme I, *b* (Fig. 248) shows in cross-section the change that takes place in the normal lumen as the result of intraglandular proliferation—the continuous sprouting of fresh

epithelial cords. The gland becomes enormously dilated by proliferation into the neighboring tissue, the lumen is filled with epithelial cords beyond the limits of the original gland, and these cords are everywhere covered with a single layer of epithelium. These epithelial proliferations which begin in individual glands are easily recognized and readily traced if the stroma between the glands is still preserved in some degree; but if the degenerated glands are in immediate contact with one another, it is impossible to trace the epithelial proliferations back to a single gland; instead, disorderly, tangled and matted cords of epithelium (resembling a whorl of earthworms, Fig. 239) are produced. If even beginning stratification develops at certain points —since malignant adenoma merely represents a peculiar architectural variety and not a specific unalterable formation—a glandular carcinoma derived from malignant adenoma results. Ultimately the picture of malignant adenoma may be entirely obscured. Malignant adenoma is a carcinoma of peculiar architecture. The proliferation of the cells continues for a long time or altogether in a single layer; but at any moment this single layer may be replaced by stratification. Malignant adenoma may at any time be converted into the other forms of glandular carcinoma.

Inverting Adenoma.

FIG. 251.—SCHEME II, *b*: GENESIS OF MALIGNANT ADENOMA OF THE BODY IN CROSS-SECTION; EVERTING FORM. (Original.)

FIG. 252.—LONGITUDINAL SECTION OF A MALIGNANT ADENOMA OF THE BODY; EVERTING FORM: somewhat irregular, 'ghostly,' glandular arrangement. (Original.)

There is another form of malignant adenoma which is glandular throughout, showing genuine gland-tubes in longitudinal and cross-section, and in which the stroma surrounds the cells, instead of the cells being attached to the stroma. These forms of malignant adenoma are illustrated in Scheme II, *a*, in longitudinal section (Fig. 250), and *b*, in cross section. Scheme II, *a*, shows the normal gland in longitudinal section. Small eversions or evaginations are produced at every point in the periphery of the gland, gradually becoming larger, and continue to ramify by producing further evaginations. The normal gland apparently remains in the centre and becomes surrounded with glandular ramifications. This malignant proliferation continues to spread indefinitely, ultimately destroying the surrounding tissue, the organ, and by metastases and cachexia, the entire body. If the proliferations which begin in individual glands are separated by stroma, the genesis of the growth in individual glands is simple and readily seen. If the glandular ramifications invade the domain of adjoining, likewise degenerated, glands and the lumina of the glands are side by side, and one glandular proliferation in contact with the next, the

Everting Adenoma.

origin of the growth in individual glands can no longer be demonstrated. The glandular lumina of the glands themselves are in contact, and the cells of the individual glands are almost back to back (*dos-à-dos*). This form of malignant adenoma, which is termed everting to distinguish it from the inverting form produced by intraglandular proliferation, retains its peculiar feature—the arrangement of the cells in a single layer—longer than the inverting form; but since the differences are not specific, and these tumors merely represent different forms of the carcinomatous architecture, stratification may ultimately develop here and there, and everting malignant adenoma may also occasionally be converted into a glandular carcinoma. In cross-sections the change is clearly seen to be due to the evagination; the apparently normal round or oval lumen of the gland—the 'mother gland'—is hardly changed at the centre, while around it the tissue is everywhere infiltrated by the radiating glandular sprouts. In Scheme II, *b* (Fig. 251) the original lumen for the sake of clearness is drawn in somewhat heavier outline than the remainder of the picture. It may also be remembered in studying malignant adenoma that combinations of the intraglandular and extraglandular forms may occur, and that the two processes may be present in the same, or in adjoining glands alternately. This explains why it is not always possible to make every strand of epithelial cells, every glandular form of cancer, correspond strictly to one or the other scheme. If it is also remembered that malignant adenoma is merely a cancer of peculiar architecture which is capable of being converted into other forms of carci-

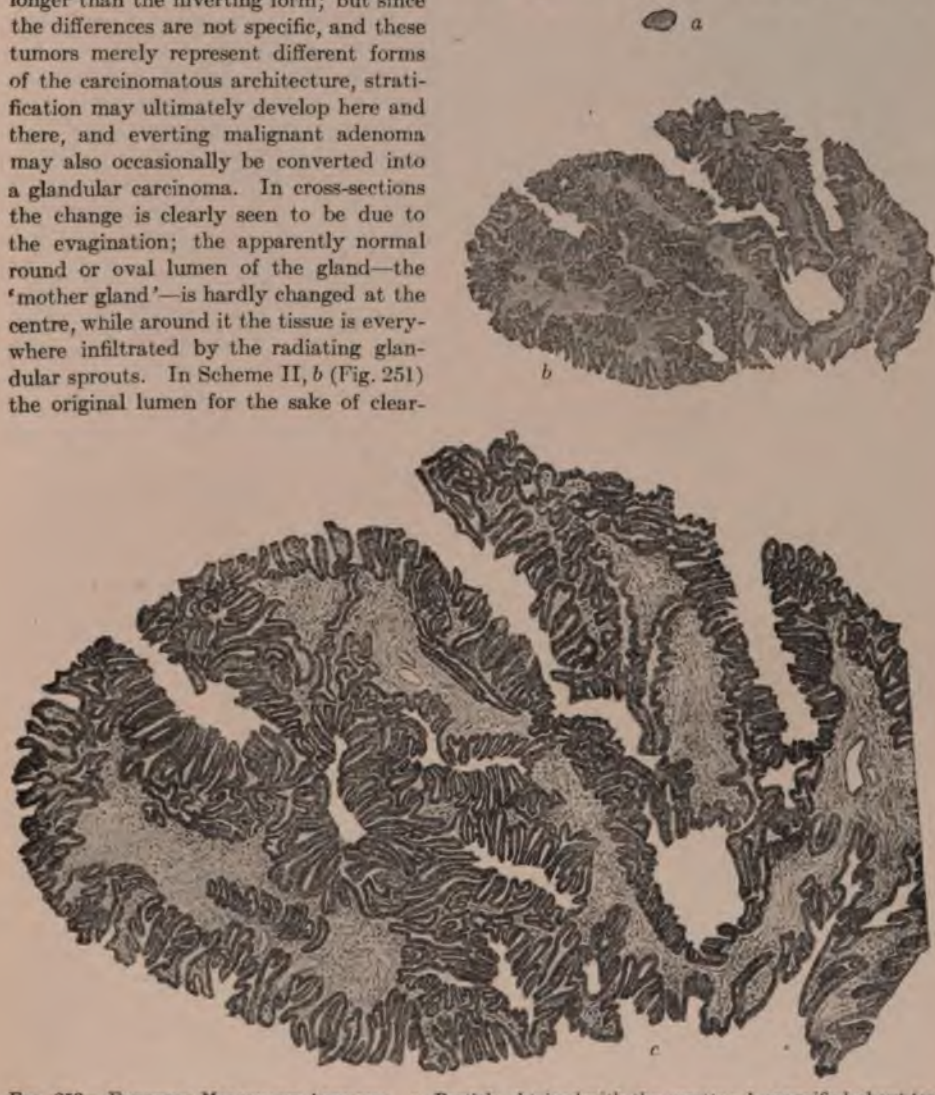


FIG. 253.—EVERTING MALIGNANT ADENOMA. *a*, Particle obtained with the curette; *b*, magnified about ten times; *c*, magnified about twenty-five times. (Original.)

noma, it will not be difficult to differentiate it from these other forms; hence a malignant adenoma may give rise to a glandular carcinoma (adenocarcinoma, or carcinoma adenoides) and, if the cell proliferation continues, to a cancer with solid plugs and alveolar carcinoma.

FIG. 254.—TWO UTERINE GLANDS IN PROCESSES OF MALIGNANT DEGENERATION (inverting malignant adenoma). At one point of the wall, *a*, combined with the everting form. (Original.)

In view of the importance of properly recognizing the various forms, I have chosen for illustration a particle of tissue (Fig. 253), *a*, natural size; *b*, magnified approximately ten diameters, in which the malignant structure is already clearly seen; and *c*, magnified twenty-five times, in which the details of everting malignant adenoma are fully recognizable. In

FIG. 255.—MALIGNANT ADENOMA, under higher magnification: *a*, approximately longitudinal section; *b*, approximately transverse section (inverting form). (Original.)

Fig. 254 two contiguous glands of a malignant adenoma are represented, which sufficiently show what an amount of epithelial destruction takes place if, instead of two, innumerable glands altered in this way are present side by side. Finally, in Fig. 255, *a* and *b*, the inverting type of malignant adenoma is shown in high magnification.

Another histologic point is that in malignant adenoma the nuclear figures retain a direction corresponding to the side by side proliferation of the cells; the line of division

is parallel to the base of the cell, not, as is ordinarily the case when the cells are piled up on each other, in a direction more or less vertical to the base (Amann).

A lymph-carcinoma is a carcinoma in which the lymph channels continue to proliferate, like the cancers of the vaginal portion and the cervix, which are designated worm-eaten on account of their resemblance to lymph vessels; they are rarely seen in the body.

In reviewing the histologic pictures of carcinoma of the uterus we are struck, first, by the great variety in the external appearance of the pictures; and, secondly, by the fact that in the main each segment of the uterus—the vaginal portion, the cervix and the body—possesses its individual form of cancer. Malignant adenoma is found chiefly in the body, is rare in the cervix, and still rarer in the vaginal portion. In the cervix it occurs practically only in the form of everting adenoma. The 'worm-eaten' variety occurs rarely in the body, still more rarely in the vaginal portion, and more frequently in the cervix. Glandular forms of the fenestrated type are practically seen only in the body.

The Variety Observed in the Forms of Cancer Corresponds to the Various Segments of the Uterus.

Owing to the great multiplicity of forms, it is necessary to be able to recognize the individual forms in order to avoid mistakes in comparing them with the pictures of carcinoma in other organs. This applies particularly to malignant adenoma, which has been so often incorrectly interpreted. Another important point is that the situation of the cancer in the uterus can be determined, if not with absolute certainty, at least with great probability, from the microscopic picture.

With regard to the nomenclature, it may be added that carcinomata with solid epithelial masses are usually called alveolar; carcinomata with a central lumen are termed glandular (adenocarcinoma) on account of their resemblance to the structure of glands. These terms are merely descriptive, for a central lumen may be produced in a single large alveolar cancer 'secondarily,' *i.e.*, as the result of central degeneration; hence the expression 'glandular' does not always indicate the origin of the carcinoma. Malignant adenoma is a cancer with a single layer of epithelial cells, which may be converted into a carcinoma with stratified epithelium (adenocarcinoma), or even, especially the everting form, into an alveolar cancer. The description of a microscopic preparation must be such that it will at once produce in the hearer a mental picture of the preparation.

Nomenclature.

Malignant Syncytioma (Malignant Chorio-epithelioma).

A discussion of cancer of the uterine body must also include one other malignant neoplasm which differs from most other neoplasms by certain definite properties not observed in any other—the **malignant syncytioma** (carcinoma syncytiale, Kossman; malignant chorio-epithelioma, Marchand). In the first place, malignant syncytioma has

a definite etiology. Since it originates in the epithelial covering of the fetal villi, it cannot occur without pregnancy; it is possible only at certain periods of a woman's sexual life; it does not occur before sexual maturity, nor after the power to conceive has ceased. It is characterized by its definite seat in the genital tract, namely, in the body or in the tube, although it may also develop in the abdomen (abdominal pregnancy), or in the ovary (ovarian pregnancy). Other exceedingly interesting points about malignant syncytioma are its development from fetal, instead of maternal tissues, often degenerated in the very earliest stage of pregnancy, and that the neoplasm which ultimately destroys the mother's life remains until the end a fetal neoplasm composed of fetal elements.

Malignant Syncytioma.

So-called Chorio-epithelioma in the Male Ought to be Designated Syncytioma Ectodermale (Masculinum).

The unique position of malignant syncytioma remains unshaken, although several cases of chorio-epithelioma in the male have been described; cases therefore in which there was no pregnancy, and in which other peculiarities of feminine malignant syncytioma were impossible. Chorio-epithelioma in the male is intensely malignant; whether the choice of the name is justified, will not be discussed in this place. So far, fetal villi have never been demonstrated in man; in the histologic composition the tumors appear to be absolutely identical; the neoplasm originates in ectodermal elements; it is a masculine ectodermal malignant syncytioma, not a malignant chorio-epithelioma.

Malignant syncytioma in woman is a malignant neoplasm of the epithelial covering of the fetal villi—a true malignant chorio-epithelioma.

For the histologic composition of the villi the reader is referred to the section on the Microscopic Diagnosis of Pregnancy. In the placental villi, we distinguish the connective tissue portion which accommodates the blood-vessels and the epithelial investment. The epithelial investment in turn is composed of the ectodermal layer in immediate contact with the stroma of the villi and the syncytial layer which covers all the chorionic villi. Both portions of the epithelial investment are of fetal origin; the lower, which is in contact with the stroma of the villi, and is known as the layer of Langhans, must be regarded as the matrix of the upper, syncytial layer (Spuler). The layer of Langhans consists of round, translucent, faintly staining elements, with round, well staining nuclei, often looking like squamous epithelium in the microscopic picture. The syncytial layer, finely granular and containing small vacuoles, readily takes the stain; the nuclei are round and also stain deeply. As the name 'syncytial' indicates, the individual cells cannot be differentiated. The villi are attached by means of their investment to the decidua basilaris; the epithelial covering may either be destroyed at the point of attachment, or it may invade the decidua basilaris, first in the form of fine protoplasmic fibres like rootlets, or root fibres, and later in the form of larger elements with fairly well staining protoplasm, and deeply staining, large nuclei. The syncytium is apparently dissolved into individual cells which often retain a connection with each other by means of delicate threads of protoplasm. The ectodermal cells take part—sometimes to a considerable degree—in this proliferative process.

The Epithelial Covering of the Villi is Composed of an Ectodermal and a Syncytial Layer.

These fetal cellular elements, which are often found at a considerable depth in the decidua basilaris and also penetrate into the muscularis and into the vessels, are called syncytial wander-cells. Both varieties, syncytial and ectodermal, take part in this tissue invasion. In the earliest period of pregnancy a considerable proliferation takes place in the epithelial investment of the villous trunk (in the intervillous space), as also in the tips of the villi at the point where they are attached to the decidua basilaris; nodular formations resembling miliary tubercles are formed. This proliferation of the epithelial investment is found chiefly in hydatidiform mole. In severe myomatous degeneration of the uterus a very extensive syncytial infiltration

Syncytial Wander-cells.

of the decidua and also of the muscularis, extending far into the maternal tissue, has been observed (Rob. Meyer). All these proliferations are benign in character. They represent brief, temporary conditions or processes, and we may therefore speak of a benign ectodermal syncytioma (benign chorio-epithelioma).

But the constituents of the epithelial investment of the fetal villi may also undergo a malignant degeneration. In a very short time, after abortion, after hydatid mole, or even during pregnancy when the uterus is not yet evacuated, metastases may make their appearance in all the organs; in the vagina in the form of large, bluish-red tumors; metastases may appear in the lungs and in the brain; indeed even the spleen and liver may be attacked. In addition to this fulminating variety, in which everything is lost before one has time to think whether an intervention or complete extirpation is necessary, there are cases which progress more slowly. Often a microscopic examination gives the first hint that the condition is a sequel of pregnancy, at a time when pregnancy apparently no longer enters into the question at all; indeed, it seems that spontaneous recovery also sometimes occurs. To F. Marchand is due the credit of being the first to give a clear description of this malignant tumor.

The microscopic picture of malignant syncytioma contains nothing but syncytial masses (syncytial derivatives and ectodermal elements), and among them, and surrounded by them, are here and there blood-spaces containing maternal blood (Fig. 256). To make the examination more difficult, the remains of the neoplasm are distinctly recognizable only at the periphery of large necrotic masses or blood clots, so that in individual cases the condition might be mistaken for a vaginal hematoma, were it not that the clinical picture and the presence of a few syncytial and ectodermal masses at the periphery of the blood-spaces point to the true nature of the neoplasm. The necrotic, friable, reddish-yellow, often cheesy, dry masses show, in addition to the changes in the blood clots, the traces of syncytial elements that have died and are no longer capable of taking the stain—have become homogeneous and broken up into delicate fibres; while at the periphery the neoplasm itself continues to spread or gives rise to metastases. Malignant syncytioma spreads by way of the blood channels. Whereas it appears that large blood clots, hemorrhages, necrotic masses, and syncytial elements, as well as necrotic particles, belong to the genuine picture of syncytioma, one also sees proliferations and metastases in which the cellular architecture plays the most important rôle. Syncytial masses are surrounded by large accumulations of ectodermal cells and look like large, long-drawn-out giant-cells—protoplasmic masses, often containing but a few nuclei of a finely granular structure with vacuoles of various sizes—sometimes they are provided with numbers of protoplasmic processes, which may communicate with other syncytial masses. Formerly, before this neoplasm was known, it was frequently mistaken for a giant-cell sarcoma. Conversely, the syncytial masses may be so abundant and arranged in such a way as to include the scanty ectodermal cells; the latter have a pale, faintly staining cell-body, well staining nucleus, and are variable in size. By pressure they are often flattened so as to appear almost hexagonal, or

their contour may be so sharp as to suggest vegetable cells. They also contain karyokinetic figures. Thus either the syncytial masses or the epithelial cells may preponderate; neoplasms consisting entirely of ectodermal cells have also been described.

FIG. 256.—MALIGNANT SYNCYTIOMA: Syncytial and ectodermal constituents, blood-spaces; metastases from the vagina. (Original.)

The Diagnosis of Malignant Syncytioma Sometimes Difficult.

Depending on the character of the material submitted for examination, the diagnosis may be exceedingly easy; but occasionally, if only necrotic masses are obtained, or if the particles are derived from the periphery and contain only a row of single, large syncytial elements resembling the syncytial wandering cells of benign syncytioma, the diagnosis may be more difficult. The presence of necrotic tissue is more conclusive than the individual tumor elements. In simple syncytial wandering cells there

is no necrosis, but simple decidual masses infiltrated with large numbers of syncytial wandering cells may also be presented for examination along with blood clots in cases of abortion, and may occasion great difficulties. In the main, a diagnosis of malignant syncytioma must be made when, instead of a few syncytial elements, large conglomerations of cells, whether syncytial or ectodermal, are found side by side, and appear to have displaced large portions of the tissue. The diagnosis is further confirmed by the destruction of blood-vessels, or by the presence of necrotic masses, pointing to a considerable proliferation with subsequent destruction. The presence of individual elements, though fairly abundant, and infiltrated tissue, is not as yet sufficient to establish malignancy.

The Diagnosis of Syncytioma Must be Made by the Presence of Large Masses of Cells, not Individual Elements.

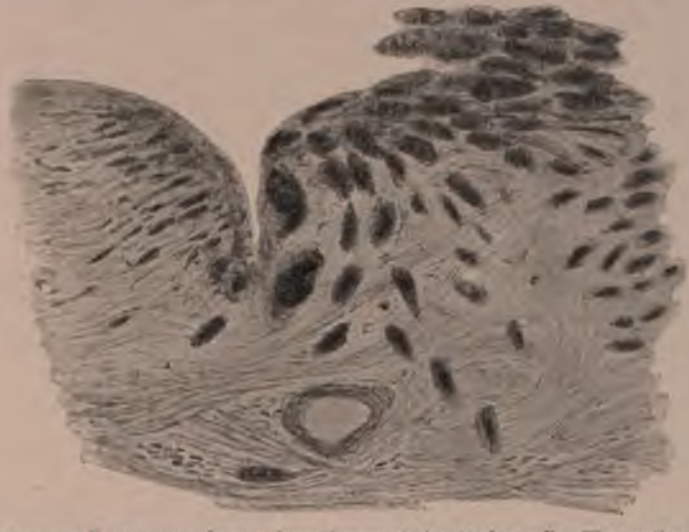


FIG. 257.—MALIGNANT SYNCYTIOMA, from a large tumor of the uterine wall. The section contains only syncytial derivatives.

Chorio-epithelioma, like malignant tumors in general, gives rise to metastases. Metastasis must be differentiated from deportations of benign proliferations, or rather of villi with a benign proliferating investment. These benign deportations are destroyed in the organs in which they are found, and the symptoms which result from these embolic particles vary according to the importance of the organ. It cannot be assumed that active processes in the surrounding tissue take their origin in these benign deportations. The behavior of the surrounding tissue is determined by its own structure; it may also be possible in exceptional cases for an originally benign deportation to undergo malignant degeneration.

At the present time opinions vary in regard to the metastatic tumors which are often observed in the vagina. These are rarely large, of a bluish-red color resembling varices, and their operative removal is followed by recovery, although they contained chorio-epithelial masses. From the fact that recovery takes place it is inferred that these chorio-epithelial masses are benign, although radical removal of all the chorionic constituents is not possible. In connection with this diversity of opinion, it is to be remembered that chorio-epithelioma is a very peculiar neoplasm with a great tendency to break down, whether it be benign or already malignant, and extirpation of the varix-like nodule is well calculated to bring on necrosis of any remaining particles of the chorio-epithelioma, with ultimate spontaneous recovery.

The decision of this question is exceedingly important, as it affects the question of total extirpation; whether in the case of a metastatic tumor in the vagina the latter alone or the uterus also shall be removed. If one of these vaginal metastases as large as an egg is shown by microscopic examination to contain chorionic masses of cells which have apparently invaded the tissue, even if recovery subsequently takes place, such large metastatic tumors ought to be regarded as malignant.

With regard to the nomenclature, we have a choice of several names; although a malignant epithelial neoplasm is usually called carcinoma, malignant syncytioma nevertheless differs considerably from carcinoma, both in its structure and in the fact that it is composed of two kinds of cells. With regard to the structure, it contains no connective tissue, the entire tumor being formed of epithelial masses. We may speak of two kinds of epithelium, in spite of the fact that one forms the matrix for the other. As regards the term malignant chorio-epithelioma there is no objection to its employment, although the tumor does not consist primarily of chorio-epithelioma, but of ectoderm into which the mesoderm grows secondarily. It is in the latter that the original ectoderm is called villous, or chorio-epithelioma. The apparently identical tumors which have been demonstrated in man, cannot therefore be properly called chorio-epithelioma, because they contain no villi and consist solely of ectodermal proliferation. The term malignant syncytioma is appropriate both for the male and for the female, since it means proliferation of the ectoderm; it is derived from the most prominent, and apparently most characteristic ectodermal constituent—the syncytium. I shall retain the term malignant syncytioma, since the name is after all merely a kind of convention to designate definite changes and definite properties by a definite name.

Nomenclature of Syncytioma.

Differential Diagnosis: (*a*) for the Clinician; (*b*) for the Pathologist.

The **differential diagnosis** has to deal separately with the difficulties, **A**, encountered by the clinician; and, **B**, those which present themselves to the pathologist. We are here chiefly interested in the latter.

A.—The clinician encounters certain difficulties in the diagnosis of carcinoma of the body. In endometritis severe symptoms arousing the suspicion of carcinoma make their appearance; and, on the other hand, carcinomata occur without any marked symptoms. Macroscopic inspection of the scrapings is inadequate for a positive diagnosis; they may be so abundant that the diagnosis of carcinoma appears to be clinically positive, whereas microscopic examination shows nothing but hyperplastic endometritis; conversely, the quantity of scrapings may be so small that no suspicion of malignancy is aroused clinically, although the condition is in fact malignant. In hyperplastic endometritis, the scrapings after appropriate treatment with alcohol, preparatory agitation, definitive hardening (see above) by their spongy appearance practically exclude the diagnosis of carcinoma, even without microscopic examination. A positive decision can, of course, be made in such a case only with the microscope. The microscopic picture of endometritic changes—be it glandular or interstitial—is so typical that there is no difficulty in distinguishing it from the various above-described pictures of carcinoma.

The spongy layer which is found in the deeper portion of the mucous membrane in glandular endometritis may occasion more serious difficulties to the pathologist, who might be inclined to think of malignant

adenoma on account of the close apposition of the glands; but the connection between the spongy layer and the upper portion of the glands, which will be found in other sections, and the prominence of the cylindrical epithelium will serve to obviate the difficulty. If there is any doubt, several series of sections must be examined, as a study of different preparations of the same scrapings will enable one to arrive at a final decision.

Any one who appreciates the importance of microscopic examination will agree that every physician ought, if possible, to submit all scrapings to a pathologist if he cannot examine them himself. The prognosis, as well as treatment, depends on the diagnosis; as, for example, if clinically there is a suspicion of malignant degeneration and the microscopic preparation clearly shows the glands of pregnancy (Opitz-Gebhard). The possibility of mistaking the changes of pregnancy in the uterine glands for carcinoma should be mentioned at this point. The structure of the epithelial cells in the uterine glands during pregnancy suggests carcinomatous degeneration of glandular epithelium (Fig. 258). From lack of experience even prominent pathologists have failed to recognize this special change in the gravid uterus, and hysterectomies have been performed on the strength of this picture of the Opitz-Gebhard glands, which merely indicated the postabortum state.

Fig. 258.—Alterations of Pregnancy in the Uterine Glands. Stratification (piling up of the cells) simulating carcinoma; Opitz-Gebhard glands.

Portions of expelled and degenerated myomata may be submitted, and the diagnosis must be determined by the presence of muscle fibres and the absence of other changes. Placental polyps and large placental masses have been mistaken clinically for carcinoma, when examination showed the microscopic picture of villi with their epithelial investment and the large decidual cells, establishing the diagnosis of products or alterations of pregnancy. The hysterectomy which was performed on the strength of clinical examination alone might have been avoided had the glands of pregnancy been demonstrated with the microscope. Conversely, in cases in which a clinical diagnosis of abortion has been made, the evacuated masses may be found to consist not simply of villi

or decidual remains, but almost exclusively of syncytial tissue, and the difficult question has to be decided whether the alteration is malignant or benign. Simple syncytial wandering cells or ectodermal elements would indicate the latter; while large masses of syncytial and ectodermal cells, with hemorrhages and necrotic tissue, are more in favor of malignant degeneration. The decision of this question is often difficult and may require several examinations. It should also be mentioned that the cellular elements in the decidua cannot always be distinctly differentiated as decidual cells or ectodermal cells, as they often resemble each other very closely; nor has it any great value for the decision of malignancy.

Since we know that malignant syncytioma may follow hydatidiform mole, the question whether this degeneration is present may arise after such a mole has been removed from the uterus. The decision may be difficult, because if the symptoms are clinically suspicious, the finding of many syncytial elements in the curettage might arouse a suspicion of beginning malignant degeneration; it is exceedingly difficult in such cases to give a decision on microscopic grounds, but it is to be borne in mind that as a general rule the presence of individual syncytial elements proves nothing, even though they may occasionally be present in large numbers. In the decidua and in the highest layers of the muscularis malignant degeneration of the villous stroma or of the decidual cells in the decidua, does not enter into the differential diagnosis. That it occurs has often been maintained, and is not impossible; but as yet it has never been proved. Aschoff has reported a case which has a bearing on malignant degeneration of the villous tissue. Neumann has described invasion of the villous stroma by syncytial elements. The statement that, when this occurs after hydatidiform mole, a malignant syncytioma is also present, has never been confirmed.

Malignant Degeneration of the Villous Stroma.

B.—If the clinician who turns to the pathologist to clear up his doubts encounters difficulties in the diagnosis of carcinoma, the pathologist himself often has to deal with the most perplexing conditions when he is called upon to render a decision in clinically doubtful cases; but practice and familiarity with the histologic pictures, as well as repeated examinations will usually enable him to accomplish his task. The occasional difficulties encountered in the diagnosis of malignant syncytioma have been referred to, as has also the possibility of confusing the Opitz-Gebhard glands of pregnancy with adenocarcinoma (Fig. 258). Scrapings obtained from the body occasionally contain stratified epithelium which, however, has no malignant significance; it may occur in small polypoid proliferations, which it

Difficulties in the Diagnosis of Carcinoma Encountered by the Pathologist.

Stratified Epithelium.

only partially covers. The stratification, usually consisting of only two layers, may cover large portions of the mucous membrane uniformly; some individuals appear to have two layers of epithelium throughout (Rob. Meyer). Circumscribed stratification occurs in the body, described by von Rosthorn as psoriasis, and cases of this kind are always suspicious. The differential diagnosis in all cases presenting epithelial stratification must be based on the fact that the process is not progressive. Epithelial proliferations with stratification occurring in corporeal polypi are positively malignant only when they extend beyond the base of the polyp into deeper layers; the fact that the epithelial covering penetrates into the polypi themselves proves nothing. Among the direct sources of error must be mentioned the deceptive pictures seen in microscopic preparations; oblique and flat sections may produce the appearance of solid epithelial formations; flat sections, and sections that are too thick, make the fundus of the uterine glands appear like solid, cellular plugs (comp. microscopic diagnosis of endometritis). Oblique sections, especially through ridges or evaginations of epithelial cells, suggest stratification and may thereby arouse a suspicion of beginning malignancy. A careful revision of the pictures, with particular attention to the direction of the section, and repeated examination of sections cut as thin as possible, will enable the examiner to make a correct interpretation. What looks like beginning stratification may be shown not to exist by cutting thin sections and carefully observing their direction.

Psoriasis of the Uterine Mucosa.

Significance of Epithelial Proliferation in Polypi.

Deceptive Pictures in Microscopic Preparations.

Stratification is found much more frequently in the cervix and in cervical structures than in the body. In the dilated cervix (ectropion) the original cylindrical epithelium may become stratified and converted into a thick layer of epithelial cells (epidermidalization). Erosions of the cervix and of the vaginal portion may show a conversion of the original cylindrical, into stratified epithelium in the course of healing; but the fact that the process does not extend into the deeper layers will prevent an erroneous diagnosis of malignancy. In the healing process and in epidermidalization we have a simple metamorphosis, while in carcinoma there is abundant production of epithelial masses extending into the deeper layers of the tissue.

Epidermidalization and the Process of Repair.

A knowledge of the epithelial metamorphosis that takes place in polypoid proliferations in the cervix is exceedingly important; in fact, the importance of the epithelial changes that take place in the polypi generally is not sufficiently appreciated. The longer the cervical canal and the greater the protrusion of cervical polyps, the more intense is the metamorphosis of the cylindrical epithelium. The inner surface may be covered with cylindrical epithelium or very thin layers of secondarily stratified epithelium, while the outer surface already shows a thick epithelial covering in which, finally, papillæ also develop. Not only the surface, but the glandular formations within the polyp take part in this epithelial metamorphosis. In cross-sections the picture thus produced may be difficult to distinguish from carcinoma, particularly if the examiner is inexperienced; onion-like formations (epithelial pearly bodies) may be produced by the proliferation of the epithelium, simulating cancroid.

Epithelial Changes in Polyps.

Great caution is necessary in giving an opinion in regard to the malignancy of epithelial conditions found in cervical polyps; unless the epithelial proliferation extends beyond the base of the tumor, the diagnosis of carcinomatous polyp is not justified. Epidermidalization may be confounded with carcinomatous degeneration. In contrast to the genuine carcinomatous degeneration that occurs in polyps either of the body or of the cervix, the shape of the glands is preserved in the process of epidermidalization, whereas in carcinoma the degenerative process is unmistakable; the irregularities in the architecture

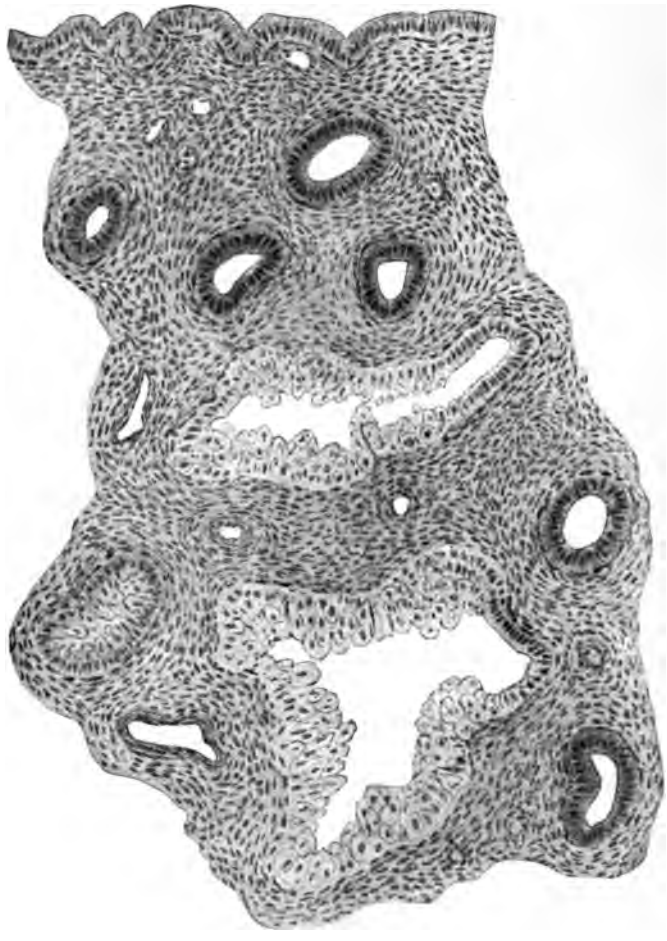


FIG. 259.—PECULIAR GLANDULAR CHANGE, partly resembling the alteration observed in pregnancy, and partly that of glandular cancer; necrobiotic processes with cellular proliferation. (Original.)

of the cells in carcinoma, in contrast to the uniform metamorphosis which takes place in epidermidalization, also has some diagnostic value. With a little practice it is easy to make a positive diagnosis, except in very rare cases, in which some doubt must always remain.

The diagnosis between carcinomatous and non-malignant degeneration likewise presents great difficulties in atrophic conditions of the mucous membrane of the glands. Associated with metamorphosis and proliferation of the epithelium is a peculiar form of desquamation; the gland becomes enlarged, the tunica propria is destroyed, the epithelium may be preserved at certain points in the lumen, and converted into squamous epithelium at others; the cylindrical epithelium becomes flat, stains less intensely and, instead of a single layer of cells, becomes multiple (Fig. 259). The picture resembles that of the Opitz-

Gebhard glands of pregnancy. As a result of various etiologic factors which cannot always be clearly recognized (atrophy, pregnancy, peculiar disturbances of nutrition, climacteric), in inflammatory processes and in passive congestion (hyperemia in polyps), peculiar but benign changes and proliferation of the epithelium occur in the epithelial structures, which may easily be mistaken for malignancy. If the inflammatory irritation in the subjacent tissue (small celled infiltration of the tissue) is very great, the single layer of cylindrical cells on the surface may be converted into robust, stratified squamous epithelium without becoming malignant; thus, in salpingitis (Fig. 260) the surface epithelium is occasionally converted everywhere into stratified squamous epithelium. The inflammatory irritation gives rise to a kind of stratification which may be designated psoriasis or pachydermia.

Peculiar Behavior of the Epithelium in Atrophic Conditions of the Mucous Membrane.

Differential diagnosis between carcinoma and malignant syncytioma, and between the latter and sarcoma. Aside from the history, large syncytial masses point to syncytioma. The distinction between syncytioma and sarcoma is somewhat more difficult. In sarcoma, particularly the giant cell variety, the irregular, constantly changing picture of the cellular constituents is typical; while in syncytioma the picture of the syncytial masses and ectodermal cells is in the main uniform, the transition from small to large cells, with irregular nuclei, is characteristic of sarcoma. We no longer regard giant cells as belonging exclusively to sarcoma, since we know that they are also constituents of syncytioma; in themselves, the giant cells do not show whether they are of epithelial (*i.e.*, syncytial) or of connective tissue (*i.e.*, sarcomatous) origin.

Fig. 260.—Salpingitis; the single layer of cylindrical cells is converted into stratified epithelium. (Original.)

There remains the differential diagnosis between carcinoma and sarcoma. In view of the importance and frequency of sarcomata, they will be treated in a separate chapter.

Sarcoma of the Uterus.

In discussing **sarcoma of the uterus** it is not necessary to retain the strict division into the vaginal portion, cervix, and uterine body. Sarcoma is a malignant connective tissue neoplasm, while carcinoma represents a malignant epithelial growth. In sarcoma we have, in addition to simple numerical increase of the elements (hyperplasia), a change of the original type (atypia, heteroplasia); the small round or spindle cell is converted into elements which are larger than ordinary cells, with large and often irregular nucleus; the latter is often much larger than the original connective tissue cell. The unrestricted proliferation produces at first local destruction, and later metastases in distant organs (heterotopia); the proliferation is not uniform: large and small cells are found side by side. The change in the

Sarcoma of the Uterus.

Atypia of the Elements in Sarcoma.

type of the cell and the want of uniformity in their arrangement are the important diagnostic points. In some cases, the irregular distribution of the large nuclei produces a tigerish, spotted appearance of the microscopic preparation, as if a dark material had been dusted over it. The sarcoma usually develops uniformly and gradually from the connective tissue or ground substance, without a sharp line of separation between the normal or non-malignant, and the sarcomatous tissue; in carcinoma, on the other hand, the architecture is discontinuous, the proliferating epithelial masses appearing sharply circumscribed in the alveolar spaces.

In Sarcoma the Transition to (Normal) Connective Tissue is Gradual, Continuous.

Depending on the variety, shape, and size of the altered cells, various forms of sarcoma are distinguished. In large-cell sarcoma (Fig. 261) the connective tissue elements or stroma cells are converted

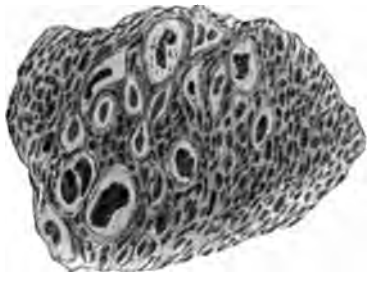


FIG. 261.—LARGE-CELL SARCOMA; gradual transition from connective tissue to excessively large cells with large nuclei and irregular arrangement. (Original.)

FIG. 262.—SPINDLE-CELL SARCOMA (MYOSARCOMA). Metamorphosis of the narrow muscular elements into large, spindle-shaped elements with very large nuclei. (Original.)

into excessively large round, or oval elements, with irregular outlines, and arranged without definite order, large and small cells lying side by side. The nuclei are sometimes enormous, their shape round or irregular; they may fill the entire cell. In the microscopic preparation the individual elements are in the main easily distinguishable by their contours. This form of sarcoma is found in alterations of the mucous membrane of the vaginal portion.

Large-cell Sarcoma.

Spindle-cell sarcoma (Fig. 262) usually originates in the cells of unstriped muscle; the connective tissue cells, or narrow muscle fibres with rod-shaped nuclei, which sometimes can be recognized only by their nuclei, as the cell body is barely visible, are converted into large spindle-shaped, long-oval elements; the large nucleus is oval and of variable size. The cells often resemble the muscle fibres of the gravid uterus. The muscular elements produce the impression of having become directly metamorphosed. The arrangement of the degenerated elements, already distinctly sarcomatous, corresponds to that of a myoma,

Spindle-cell Sarcoma.

with interlacing and radiating bundles (myosarcoma). If the sarcomatous change in the muscle fibres is associated with considerable proliferation of connective tissue, it is difficult to isolate large sarcomatous elements. The contours are not easily recognized, and the large irregular nuclei seen in the microscopic preparation directly indicate a sarcomatous change (fibrosarcoma).

In the third variety, the giant-cell sarcoma, large polynuclear cellular masses—myeloplaques—are scattered here and there amidst the enormous cellular proliferations. If the remaining connective tissue elements are not materially enlarged, the contours of the giant-cells may be obscured, particularly if the section is rather thick; hence in working with this variety of sarcoma the sections must be made as thin as possible.

Giant-cell Sarcoma.

The fourth variety, which is often difficult to recognize, particularly if the scrapings contain only small particles, is the small round-cell sarcoma or lymphosarcoma (Fig. 263). The sarcomatous elements are but little larger than the stroma cells, and resemble them in general appearance. The diagnosis is based on the fact that all the sections made from the scrapings, on repeated examination, show nothing but small round cells without a trace of mucous glands. In very thin sections, which in this form also are particularly desirable, irregularities in the size of the nuclei and of the cells are also occasionally observed, and materially assist the diagnosis. Individual cases show a peculiar cord-like arrangement of the sarcomatous cells; the degenerated masses are sharply separated from the surrounding tissue, and it is impossible to find any transitional forms. Within the interior of the cord-like masses the elements may be loosened in their connections, and thereby appear almost like epithelial cells. In this way a sarcoma may simulate an alveolar structure.

Fig. 263.—Lymph-cell Sarcoma (small round-cell sarcoma). Among the individual cells, which are almost uniform in size, a few larger nuclei and an occasional polynuclear cell are seen. (Original.)

Lympho-sarcoma.

The behavior of the glands in sarcomatous tissue is variable. As a rule the glands are destroyed, but they may survive apparently as normal glands within this sarcomatous stroma, or they become enlarged, and the epithelium is altered and becomes more stratified; the glands become carcinomatous, but the carcinoma is not the most important feature; it seems that the carcinoma "has developed against its will," if the expression may be used. It plays merely a passive part. This combination is often found in the papillary racemose sarcoma (papilloma) of the vaginal portion or cervix, to which the term carcinosarcoma has been applied. A similar picture is seen in a rare and most interesting form of sarcoma occurring in the uterine mucous membrane. The stroma tissue surrounding the glands undergoes a sarcomatous degeneration. The different forms of periglan-

dular interstitial endometritis will be discussed under the head of endometritis. Periglandular interstitial endometritis gives rise to a periglandular sarcoma, part of the gland is surrounded by an areola of sarcomatous stroma cells, and the originally isolated areolæ may gradually become confluent. The behavior of the gland cells in this form of sarcoma is interesting. Sometimes the epithelium is gradually destroyed, leaving a space filled with detritus, which may also disappear; or stratification takes place and the gland apparently becomes carcinomatous; but its appearance is neverthelcss such as to produce

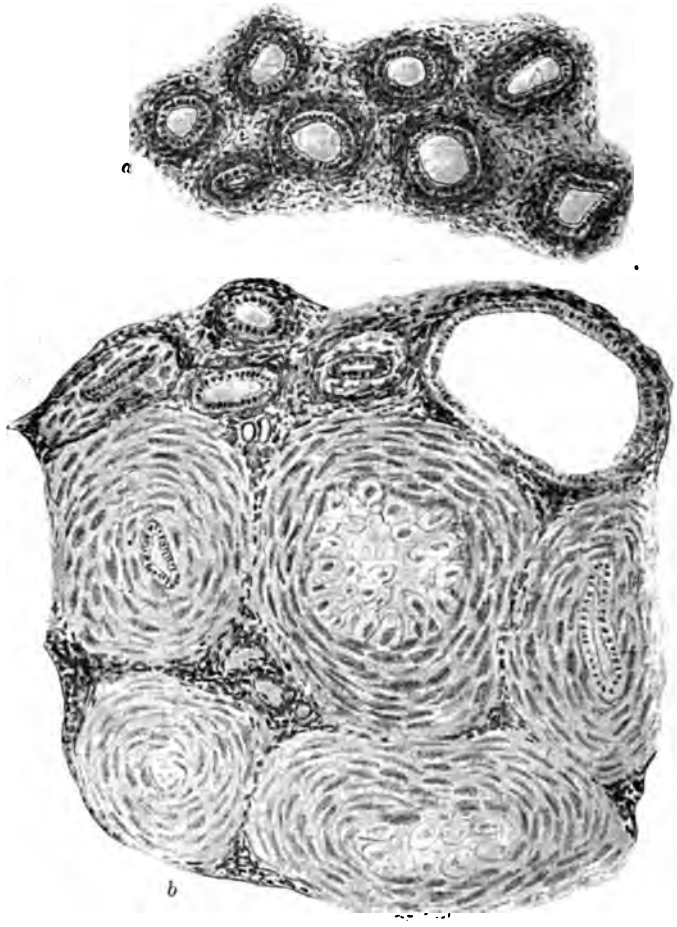


FIG. 264.—*a*. PERIGLANDULAR ENDOMETRITIS; *b*. SARCOMATOUS DEGENERATION OF THE STROMA SURROUNDING THE UTERINE GLANDS, with preservation, atrophy, or proliferation of the glandular epithelium. (Section from a uterus removed on account of carcinoma.) (Original.)

the impression that sarcomatous degeneration is the most important change present. Hence carcinosarcoma may occasionally be seen in the corporeal mucous membrane. This periglandular form of sarcoma resembles the so-called perithelioma, in which sarcomatous degeneration occurs around the blood-vessels.

Endothelioma.

Endothelioma is a neoplasm originating in the endothelial cells of the lymph vessels; it is by some authors included among the sarcomata, and often confused with genuine carcinoma—the epithelial

neoplasm. In the uterus endotheliomata are observed in the vaginal portion, and especially in the cervix; they represent a form of degeneration and destruction which may be designated both clinically and microscopically 'worm-eaten.' Clinically it is noted that large portions of tissue can easily be removed with the curette; the tissue has little resistance, and appears perforated. Microscopically, cylindrical (onion-like) structures in a loose retiform arrangement, with irregular swellings, are seen. Endothelioma (Fig. 265) must be distinguished from lymphocarcinoma in which the cancerous elements have simply invaded the lymph clefts; in the latter the endothelium is often preserved above the cancer plugs.

Endotheliomata Appear 'Worm-eaten.'

Endothelioma is derived from the endothelium of lymph vessels. The narrow, spindle-shaped elements lining the wall increase in size at the periphery and multiply. The lymph clefts, like the lymph vessels, are filled with small round-celled material, becoming considerably enlarged in places, and forming solid cords connected with one another by delicate processes. In malignant degeneration larger elements are produced in addition to the smaller cells. These have a distinct cell body and nuclei; they become large, resembling squamous epithelium; a cavity is often produced within the interior of the growth, and in these cavities the large cells are found like desquamated epithelium, along with the parietal epithelial layer. As the cellular masses increase in size, the retiform, jagged appearance is lost more and more, and ultimately they appear like solid cancer plugs.

Fig. 265.—Endothelioma of the Uterine Body. The endothelial cells as well as the lymph spaces are enlarged. The cells multiply and become as large as squamous epithelial cells. (Original.)

In inflammatory affections the endothelial cells which line the inner wall of the lymph vessels, so that only the slightly protruding nucleus is recognizable in profile, may 'become erect'; the cells multiply and, with their nuclei, stand vertically to the axis of the vessels. This gives them the appearance of cylindrical epithelium, and the lymph vessels resemble glandular canals or, as the result of proliferation, small glandular structures (Rob. Meyer: on the peritoneum). From this stage, which must still be regarded as benign, the malignant proliferation

develops. The glandular lymph cords undergo a marked cellular multiplication, the lumen becomes greatly dilated, and glandular cancer nests are produced. The endothelioma is converted into a lymphoid glandular carcinoma (lymphadenoma malignum, endothelioma glandulare) (Fig. 266). Except that the development of the growth from lymph vessels can be demonstrated, the microscopic picture would suggest a carcinoma originating from genuine glands.

Glandular Endothelioma.

FIG. 266.—GLANDULAR ENDOTHELIOMA. The endothelial cells are enlarged and become irregular; they multiply like epithelium, with the production of stratified glandular formations. (Original.)

Macroscopically, glandular endothelioma looks like a cancer of the cervix; it is possible that there are more varieties of glandular endothelioma than are at present known. It is an interesting fact that this malignant neoplasm may occupy the deeper layers of tissue (as "cancer nodes") underneath the well preserved surface.

Endothelioma occasionally occurs in combination with carcinoma. At the point where the carcinoma ceases in the deeper layers of the tissue the picture of worm-eaten endothelioma begins. This term is very descriptive, but is not absolutely characteristic; for it may occur quite independently, so that the endothelioma may appear both 'worm-eaten' and 'glandular.'

Chondroma and chondrosarcoma are exceedingly rare tumors, occurring in the vaginal portion or in the cervix; they may be mistaken for other malignant tumors. Pieces of genuine cartilage varying in size, and often confluent, presenting the picture of capsule-formation and division like normal cartilage, are found in tissue the seat of simple inflammation or true sarcomatous degeneration; in the latter case, the picture of chondrosarcoma is produced.

Cursory reference may be made to the secondary changes, such as myxomatous degeneration, necrobiotic processes, softening and apoplexy, which occur in sarcoma as well as in carcinoma. The lipomata and osseous, fatty, and glandular formations occasionally observed in the uterus and in myomata do not belong in this chapter, which deals solely with the microscopic diagnosis of the malignant diseases of the uterus.

Malignant Degeneration of the Vagina and Vulva.

As in diseases of the uterus, the two important changes in these structures are cancer and sarcoma. Tuberculous affections will be mentioned briefly in connection with the differential diagnosis. It is not so difficult to recognize malignant degeneration in the vagina and vulva as in the upper portions of the genitalia, because more assistance is obtained from inspection and palpation; hence microscopic examination is required practically only for confirmation and decides the

diagnosis only in doubtful affections. The nature of an ulcer in the vagina or on the vulva may occasionally be doubtful—whether simple inflammatory, tuberculous, specific, carcinomatous, or sarcomatous. Varicose formations (after the prolonged use of pessaries), associated with hemorrhage and ulceration, or without these complications, may raise the question of innocence or malignancy. It may be asked whether a rodent ulcer, clinically diagnosed as such, is carcinomatous or not; simple decubital ulcers often have a suspicious look. In the microscopic picture of an excised portion of the growth, carcinoma is recognized by the epithelial plugs which begin in the surface and continue to grow down into the deeper layers; while inflammatory ulcers merely show small-cell infiltration, and tuberculous changes are identified by the finding of tubercle bacilli and giant cells, regarded by many as specific constituents of tubercle; the nuclei in the giant cells are usually arranged eccentrically

FIG. 267.—HIDROADENOMA SUBCUTANEUM (in part diagrammatic). (Original.)

FIG. 268.—HIDROADENOMA POLYPOSUM (in part diagrammatic). (Original.)

or peripherally, in circular or crescentic lines. With regard to the diagnostic significance of spirochæte pallida in doubtful ulcerations of the vaginal portion, we have as yet no observations.

Sarcomatous degeneration, which is rarely seen in the vulva, but more often in the vagina, is recognized by the excessive prolifer-

ation of the cells and their atypical architecture (see above). Carcinoma of the vulva and of the vagina is usually of the simple alveolar type (solid plugs), or of the cancroid variety (epithelial pearly bodies).

Another form of carcinoma that occurs in the vulva is that which originates from sebaceous glands, the histologic picture of which is easily recognized. The hidroadenomata which occasionally occur in the vulva and which have been described by Gebhard, Pick and Hermann Ruge, present some difficulties in regard to their origin, and also as to the question of malignancy. They are supposed to originate in the sweat glands of the vulva, and their structure often suggests that of malignant adenoma. The epithelium often consists of only two layers, but under the influence of marked metaplasia stratification and solid epithelial plugs may develop and produce a cancerous appearance. These, or similar structures apparently originating in the same matrix, are situated underneath the surface of the vulva, which is often intact, and are about as large as a small bean (Fig. 267); or they may be pedunculated (polypoid, Fig. 268); or attached to the skin like fungous growths (Fig. 269). There is much to indicate that these structures originate in the sebaceous glands; in spite of their cancerous structure, they cannot be included among malignant neoplasms, except in rare instances. Many epithelial changes occurring in polypoid proliferations, the Opitz-Gebhard glands, are not malignant in spite of their appearance, just as there are physiologic prototypes of carcinoma—as the decidual cell is the physiologic prototype of sarcoma. Carcinoma of Bartholin's gland may have a glandular structure, thereby differing from carcinoma of the vulva and vagina. Finally, the so-called vaginal adenoma remains to be mentioned. Glandular proliferations occur underneath the epithelium, with large and small cavities lined with a single layer of epithelium of the cervical type. In one case—a tumor the size of a plum at the introitus—the tumor recurred, although the microscopic picture was not malignant; the recurrence was apparently a simple secondary proliferation. In another case, in which the tumor larger than the fist, was situated higher up, it resembled an adenomyoma, the simple, large and small glands being surrounded by muscular layers (Rob. Meyer-Weidling).

FIG. 269.—HYDROADENOMA FUNGOSUM. The origin of these three forms still remains to be determined by more detailed investigation. (In part diagrammatic.) (Original.)

Microscopic Diagnosis of Polyps and Tissue Fragments from the Genitalia.

(Myoma, Myosarcoma, Mucous Polyps.)

The following discussion will include material removed by operation as well as such as is expelled spontaneously. Diagnosis, prognosis and treatment depend on the nature of such material as determined by post-operative examination. For example, if a piece of tissue is shown to be malignant, or the base of a polyp exhibits carcinomatous degeneration, total extirpation will be performed. With a little practice the examiner will be able to make the diagnosis in many cases by a careful naked-eye inspection, but very often a microscopic examination is indispensable and should therefore never be omitted.

Organized or unorganized benign or malignant masses, products of pregnancy, may be expelled or removed from the uterus.

Unorganized membranous structures have already been described in detail and I shall here discuss the more solid, clumpy masses or fragments, which include the large calcareous or stony concretions that are expelled spontaneously or have to be removed by artificial means. These masses are derived from necrotic proliferations impregnated with shreds of calcium (polyps, polypoid myomata), or blood clots which have attached themselves in layers to placental remains. After treatment with nitric or picric acid the original, partially organized tissue can be recognized (connective tissue, muscle and fibrin). Occasionally foreign bodies are found free within the uterus and attest the great tolerance which the organ sometimes has for its contents.

Unorganized Masses.

Organized membranous structures have also been discussed in a former chapter. For the most part they represent changes due to pregnancy, although occasionally they occur independently of gestation. In addition to these, more compact, firm and even polypoid masses are observed which owe their origin to the products of conception. In these masses, which sometimes attain the size of a small apple, the villi may be visible to the naked eye and permit a diagnosis of previous pregnancy. They are the so-called placental polyps. The shape of these polyps may be either round or oval. The surface is smooth, rarely rough; the cross section not infrequently suggests the laminated arrangement seen in thrombi. The centre of these structures is formed by a vascular villous tissue.

Organized Structures.

Placental Polyps

Macroscopic examination may not suffice, particularly as a villous appearance is very apt to lead to a false diagnosis; hence in difficult cases the microscopic demonstration of villi and the finding of decidual remains, usually in a state of advanced fatty degeneration, are decisive. With the aid of the microscope it is also possible to determine, by the appearance of the villous plugs (epithelial processes) and possibly by the presence of the layer of Langhans, the period of gestation to which the structures belong. 'Villous' masses, shaggy, gangrenous fragments of myomata may simulate chorionic villi; blood clots may take the form of a villous ramification instead of a solid lump, an anomaly which has led to false diagnosis both by macroscopic and by microscopic examination. A number of malignant tumors may be shaggy or villous. The products of conception also include the small cysts or berries that are occasionally presented for examination and which owe their origin to hydatid cysts; their discharge is accompanied by severe hemorrhage.

Deception Due to Villous Appearance.

A large share of the material derived from the uterus—usually removed by operation—is supplied by **A.** myomata (myomatous polyps) and **B.** mucous polyps. Myomata may form wherever there is muscle, hence also in the cervix, although less frequently than in the body. Mucous polyps occur in any part of the uterus that is covered with mucous membrane.

Myomata and Mucous Polyps.

A. Myomata may be observed in the form of myomatous polyps. They may have a moderately thick pedicle (myoma pendulans) or be attached to the uterus by a broad base. Pendulous myomatous polyps with a moderately thick stalk are usually edematous and may exhibit either true myoma-formation or only contain a certain quantity of muscular tissue; they are usually covered with atrophic mucous membrane, while in the body of the uterus considerable hyperplasia of the mucous membrane may, and in the case of myomata usually does take place.

The more muscular, pedunculated polyps which, even if they contain but little muscle, should be designated fibromuscular (fibrous) polyps, may attain the size of a plum and are sometimes very vascular. The muscular tissue which enters with the pedicle spreads out, and the individual bundles become gradually thinner, forming a slightly radiating, diffuse arrangement. Under the atrophic mucous membrane are numerous fibrous masses which push their way in between the strands of muscle-fibres in the pedicle. These muscular or fibromuscular pedunculated polyps may be the seat of benign or malignant degeneration. Sometimes the mucous membrane alone, particularly the glands, may show a variable degree of hypertrophy: the polyp becomes glandular

Myomatous Polyps.

(polypus muscularis and fibromuscularis glandularis); the glands retain the epithelium which covers the seat of their origin, whether corporeal or cervical. Or, carcinomatous or sarcomatous degeneration may occur: the carcinoma begins in the surface (in the mucous glands) or in the glands which have penetrated the polyp. The cancer is usually alveolar, with the formation of solid epithelial plugs. Malignant adenomatous proliferations may also occur.

As a rule the pedicle is free, and removal of the polyp is equivalent to radical removal of the carcinoma; at the base there may be normal glands free from malignant degeneration. Within the polyps there is often found a combination of carcinoma and sarcoma; the sarcoma cells are usually of the large cell variety, with large, well staining nuclei; the sarcomatous masses are disseminated throughout the polyps. It appears that sarcomatous degeneration is prone to develop in polypoid proliferations whenever some nutritional disturbance (stasis, insufficient nutrition when the pedicle is thin) is combined with irritation. The first variety of polyps, which shows true myomatous development (myoma polyposum), presents on the cut surface, in addition to atrophy of the mucous membrane, the firm, hard, glistening structure of myoma, usually circumscribed and containing a network of glistening bands of muscle tissue which are often likened to asbestos, and which represent longitudinal, transverse and oblique sections of the muscular or fibromuscular proliferations. The asbestos appearance is most marked in the longitudinal bundles. Polypoid myomata are usually spherical or flattened (almond-shaped).

Combination of Sarcoma and Carcinoma in Polyps.

Uterine myomata are very broadly sessile and situated either underneath the mucous membrane or at a variable depth in the uterine muscle. The cut surface presents the appearance already described; firm, hard and whitish when there is much connective tissue, more grayish or grayish-red and softer when the muscular tissue preponderates. The tumor is called myoma, myofibroma or fibromyoma (uterine fibroid), depending on the proportion of connective tissue present. In the largest myomata, such as are usually obtained by operation, two features of special interest are observed. First, the stratified muscular layer which seems to peel off in layers which surrounds the myoma, and second, the distinctly lobular structure of the tumor. At the periphery particularly, spindle-shaped and cylindrical segments of varying sizes can be separated from the main tumor. While at the centre of the tumor this is not possible, one nevertheless gets the impression that the individual nodes of myomatous tissue were originally loosely connected and that their solid consistency is the result of adhesions.

Uterine Myomata.

Myoma, Myofibroma, Fibromyoma.

This peculiar structure is explained by the mode of growth—by apposition—*i.e.*, the original myoma at the centre grows by the constant addition to its periphery of large and small, newly-formed myomata.

Peripheral Growth with Central Proliferation.

In the layers of muscular tissue which form around the myoma, enlargements ranging from the size of a lentil to that of a bean are seen, which resemble nerve ganglia; at first these enlargements are connected with the myoma by delicate fibres, which in time become shorter and thicker, until finally the enlargements are in close contact with the tumor. By virtue of the lamellar formations in the surrounding muscle, which produce muscle-rhomboids as in the case of the gravid uterus, the myoma can be "enucleated." In the small, submiliary swellings of the muscular lamellæ, which gradually become larger and are converted into myomata, the first microscopic change is small cell proliferations (granulation tissue), from which the muscular and connective tissue portions ultimately develop. Various changes, both benign and malignant, occur in myomata; sometimes they are distinctly seen with the naked eye, but often they can be discovered only with the microscope.

Benign Metamorphosis of Myomata.

The most important of the benign changes is glandular degeneration. The glands in the mucous membrane proliferate and penetrate the myoma. Glandular degeneration (adenomyoma) may lead to the production of large structures or cysts the size of a pigeon's egg; every gland duct or gland tube (body) that penetrates the myomatous tissue may in turn give rise to fresh glandular proliferations; small glandular depressions are even found in deep-seated myomata. Considerable differences may be observed in myomata that are situated side by side; some may be free from glands while others are the seat of glandular degeneration. The glandular wall is covered with the epithelium of its site of origin, *i.e.*, corporeal epithelium, if the gland originates in the corporeal mucous membrane; the epithelium is often distinctly ciliated. The character of the epithelium decides whether a cyst or an apparently glandular space is really a gland or the result of breaking down of the tissue, or whether the cysts are derived from lymph clefts. Necrosis (necrobiotic processes) is another benign change that is frequently observed. Portions of the tumor or the entire myoma may be completely devoured by necrosis. The necrotic portions are discolored and often separated from the rest of the tumor by a sharp or indented boundary line. In the microscopic picture all that finally takes the stain is a few blood-vessels; the rest is diffuse, fibrous, and no longer capable of staining. Necrotic portions may be reddish—claret color—or quite yellow or whitish; the microscopic picture does not show true "fat," but rather a fine granular mass, edematous infiltration of the dead tissue.

Calcification, with the production of a whitish, friable mass (carbonate and phosphate of calcium) often occurs. The calcium salts are precipitated in the necrotic portions of the tissue. Direct metamorphosis (*a*) into osseous tissue not infrequently occurs. After removal of the calcium salts with picric or nitric acid the characteristic picture of bone corpuscles and their processes and Haversian canals is seen under the microscope; the bone tissue may be isolated within the tissue, or calcified portions of the tumor may be found in the neighborhood. (*b*) The occurrence of genuine fatty tissue is also interesting. A large myoma may contain enormous islands of fat, containing genuine yellow fat-cells.

Calcification.

Bone-formation in Myomata.

The most important, as well as the most frequent among malignant changes is sarcomatous degeneration. The entire myoma is rarely attacked at once, the affected portions sometimes being widely separated by healthy tissue. Sarcomatous degeneration may be suspected by the naked-eye appearance alone. The originally whitish tissue, which shines like asbestos and shows transverse and longitudinal layers from the interlacing or rhomboid fibres, in the cut surface appears slightly elevated above the surrounding level; the tissue is uniformly velvety, and the color a uniform, soft gray. Under the microscope the individual radiating and interlacing strands of muscle-tissue are seen within the fibrous structure. The deviation from the normal type seen in the nuclei is very conspicuous. The narrow, rod-shaped nuclei, which merely suggest the cell body of the muscle-cells without bringing out their contours distinctly, become large and finally excessively large, broad and oval; the arrangement is irregular and the nuclei are very variable in size. Gradually an atypical, excessive growth is seen, in addition to the spindle-shaped enlargement of the elements—spindle-cell sarcoma.—Another variety is the large round cell sarcoma. The large nuclei are often irregular both in shape and arrangement and look like macules among the smaller nuclei. The picture is irregularly strewn with dark granules. In favorable specimens the gradual transition from the normal to the sarcomatous elements can be seen. Sarcomatous degeneration of myomata is equivalent to the sarcomatous change in the glands which proliferate into the myoma (carcinomatous alteration of adenomyomata). It is possible, although rare, for carcinomatous degeneration in the neighborhood to penetrate into a myoma.

Sarcomatous Degeneration in Myomata.

Spindle-cell Sarcoma.

Large Round Cell Sarcoma.

The pathologist is occasionally requested to examine cylindrical, solid, dark red, or circular masses which suggest polypoid or myomatous

material. These masses are expelled spontaneously or appear during labor along with the child's head; or they are removed from the anterior or posterior lip of the cervix. By careful macroscopic examination these solid masses can be identified as parts of the cervix (vaginal portion). They present an outer surface covered with squamous epithelium and an inner surface showing the cervical folds. If the partially separated lip remains *in situ* for some time after labor and retains its connection with the cervix, a change in the shape of the epithelium takes place and a detailed microscopic examination is necessary to identify the tissue.

Cervical Tissue.

B. With regard to mucous polyps, they have the same composition as the soil from which they spring. Stroma and parenchyma are the same, and the proportions only are changed. Mucous polyps may be glandular or interstitial whether they originate in the body, the cervix or the vaginal portion; if glands are practically absent, a fibrous polyp results. With regard to nomenclature, the term cervical or corporeal, glandular or fibrous polyp is to be preferred to adenoma. Cervical adenoma and corporeal adenoma are also used to designate either circumscribed (polypoid), or diffuse glandular proliferation of the mucous membrane. Adenoma means a gland tumor; hence a fibrous polyp would be a gland tumor without glands or containing very few glands. The term adenoma has no advantage over polyp, to which we have become so accustomed that we are no longer disturbed by its derivation ('supplied with many feet'). On the other hand, we have also become accustomed to associating the idea of malignancy with the term adenoma.

Mucous Polyps.

The Term Polyp Preferable to Adenoma.

Polyps of the corporeal mucous membrane may be glandular. The glands may be dilated or cystic; like the surface they are covered with a single layer of cylindrical epithelium. In large cystic dilatations the epithelium is more cuboidal and of the corporeal type; the protoplasm stains well and the nuclei are central. The glands in the polyps may increase by division, or new glands may be formed by dipping down of the surface epithelium. When the glands are but little involved, fibrous polyps are produced—polypus mucosus corporis interstitialis (glandularis). Extensive, broadly sessile proliferations, which to the naked eye often present an appearance similar to that of frog-spawn, owing to slight dilatation of the glands, are designated molluscum. Alterations may take place in corporeal polyps by a simple increase in the layers of epithelium at the surface; one side of the polyp only is usually affected and the process, which is on the whole rare, is of no special significance.

Glandular Polyps.

Epidermidalization of Polyps.

Ordinary epidermalization and modifications of the pictures of polyps may result from marked increase of the blood-vessels and hemorrhages. Malignant degeneration is on the whole rare. In carcinoma the epithelium becomes stratified and proliferates; the picture is usually that of alveolar carcinoma, but malignant adenomyoma also occurs. Sarcomatous degeneration is even rarer than carcinoma in mucous polyps; but the alteration is common in processes associated with great nutritional disturbances (stasis, pressure), as, for example, pyometra.

Malignant Degeneration of Mucous Polyps is Rare.

Mucous polyps of the cervix like those of the body may be either glandular or fibrous (interstitial). Constriction of the glands occurs much more frequently than in the corporeal polyps, and the cystic dilatations are greater. The epithelium in the glands is of the tall cylindrical type, in the dilated portions somewhat shorter; the cell body does not stain and the nuclei are basally situated. The same elevations which are seen in the cervical glands and which in transverse sections look like papillæ may occur in polyps. Conversion of the surface epithelium into a stratified epithelial layer is much more common than in the case of corporeal polyps; the stratified epithelium projects into the glands, or even to a considerable depth into the substance of the polyp. If the cervix becomes greatly dilated or the cervical polyp emerges from the dilated os epithelial pearly bodies, onion-like structures, which are very apt to suggest malignancy, may develop in the epithelium. In transverse and oblique sections the pictures are very often suspicious, the tissue appears to contain 'cancer nests' and 'cancer plugs.' Malignant degeneration is rare in polyps, and if epithelial changes are present, great caution must be observed in giving an opinion on the microscopic picture. As already emphasized, the structure of the base must be particularly investigated in the case of polyps. The surface of cervical polyps, like the mucous membrane of the cervix itself, may be the seat of papillary proliferation (corresponding to papillary erosion). New forms of cervical glands may also result from dipping down of the surface epithelium.

Fig. 270.—Fragments from the Bladder: papilloma of the bladder. So far as the stroma can be seen, it contains no cancerous invasion (suspicious case). (Original.)

Cervical Polyp.

Epidermidalization of Cervical Polypi.

Polypoid proliferations which occur in the vaginal portion should not be designated mucous polyps. They originate in the erosion

glands, which are constricted off by the epidermidalization, become enlarged from the accumulation of mucus, and finally converted into 'follicles' (ovula Nabothi). By proliferation so-called follicular polyps may be formed; cervical polyps often develop in the same manner. No noteworthy changes require mention. In the vaginal

FIG. 271.—FALLOPIAN TUBE: single layer of cylindrical epithelium. (Original.)

FIG. 272.—URETER: stratified epithelium. (Original.)

portion hard, villous, polypoid structures are occasionally found, covered on the outer surface with the stratified epithelium of the vaginal portion, and occasionally with cervical epithelium on the inner surface; but the stroma of these structures is exactly like that of the portio vaginalis. The formation of these structures must be attributed to ulceration of one lip, or a large portion of one lip, during labor (see

FIG. 273.—VERMIFORM APPENDIX: fecal remains, glands, follicles. (Original.)

above). The racemose polypoid proliferation—exceedingly malignant sarcomatous changes (cauliflower-tumors)—have already been discussed in connection with cancer (see above).

Urethral polyps often have a very thick epithelial layer with crypt-like depressions; in the microscopic picture they are apt to arouse the suspicion of cancerous degeneration. As a rule the stratified epithelium is covered with a layer of cylindrical cells (comp. Fig. 59). As in the case of polyps, the greatest caution is necessary in making a diagnosis.

So-called urethral fungus, which is often submitted for an opinion, usually contains granulation-tissue, rather dilated vessels and a thin layer of epithelium. Fragments of tissue from the bladder may be quite difficult to interpret (Fig. 270). Papillary proliferations (papilloma vesiculae urinariae) may be submitted for an opinion which are covered with unusually thick epithelium or possess only a single connective tissue stalk. As only a small quantity of material is usually available, it is often very difficult to decide whether the epithelial proliferation is extending progressively into the deeper layers of the tissue, in other words, whether carcinoma is present.

Tissue Fragments from the Bladder.

Occasionally certain other peculiar things, derived from the genitalia or said to be derived from the genitalia (various foreign bodies), are submitted for examination. Parasites (oxyuris) occasionally get into the genitalia. I shall not discuss these things here, interesting though they sometimes are. A question which the examiner is occasionally asked is whether certain cord-like, firm, whitish particles which are found in extirpated myomata or uteri are ureter, vermiform appendix or Fallopian tube. The pieces are often so small that the decision cannot be made with the naked eye. The tube (Fig. 271) is lined with a single layer of cylindrical epithelium, differing from the ureter (Fig. 272), which has stratified squamous epithelium; some differences in the arrangement of the muscle fibres are also observed. The vermiform appendix (Fig. 273) may be identified by fecal contents and by the glands and follicular structures contained in the mucous membrane. Small pieces of uterine muscle, which may be often included in a specimen obtained from a greatly altered and adherent tube, are recognized by the picture of the muscular fibres and by their arrangement. It is important to subject everything that is expelled from the uterus and everything derived from the uterus to careful macroscopic inspection and, if there is the slightest doubt, the tissue must also be examined under the microscope. The expert will usually be able to interpret with the naked eye things which a less practiced examiner will find difficulty in recognizing even with the aid of the microscope.

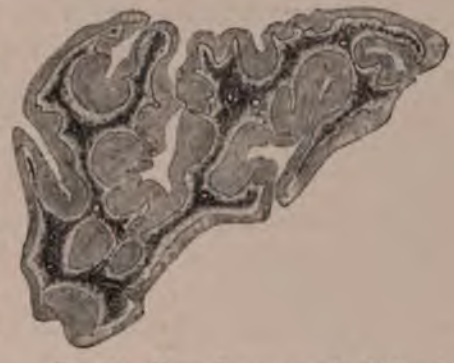


Fig. 274.—Nasal Polyp: greatly thickened, stratified, squamous epithelium with gland-like invaginations in the greatly inflamed and irritated tissue. (Original.)

In connection with myomatous and polypoid masses mention should be made of the fragments of tissue which sometimes adhere to the examiner's finger and the study of which is often very important. Careful microscopic examination in the recent state or after embedding the material may prevent serious errors. The diagnosis made with the finger during examination, *e.g.*, the diagnosis of abortion, may prove to be erroneous. In beginning carcinoma, which is situated at the internal os and immediately above that point, the most experienced clinician may make a mistake in diagnosis unless a microscopic examination is made of the particles of tissue that adhere to the finger.

Tissue Fragments Found at the Clinical Examination.

There is one mistake—that of basing one's judgment on individual cells—which must be carefully avoided. There are no specific elements that indicate cancer with absolute certainty. The bladder cells are the physiologic prototypes of carcinoma, as the decidual cells are the proto-

types of sarcoma. In very rare cases certain conclusions may be drawn from solitary epithelial cells (supported by clinical observation), if, for example, material without any other foreign admixture is obtained from the cervix in which large epithelial structures with abnormally large nuclei are found—elements which do not occur in this situation under other circumstances. Not only the elements of malignant tumors have their physiologic prototypes and are therefore not in themselves characteristic, the structure of malignant neoplasms also has its prototype. The mucous membrane of the tube (see above) in its abdominal portion closely resembles malignant adenoma and might be mistaken for a metastasis. Benign changes in certain portions resemble the malignant neoplasms that occur elsewhere: the picture of an ovarian cyst resembles that of glandular cancer elsewhere. Changes of the nasal mucous membrane (nasal polyp, Fig. 274), judged by their structure alone, might be mistaken for carcinoma if found in other situations, and the same might be said of papillary changes in the urethra. Hence the study of diagnosis must include not only the study of the normal composition of tissues, but also a knowledge of the changes that occur in different situations. Malignant degenerations vary in their appearance and form according to the organ that is attacked.

A Microscopic Diagnosis Based on Individual Cells is Deceptive.

Bladder Cells and Decidual Cells are the Prototypes of Carcinoma and Sarcoma Respectively.

Physiologic Prototype of Carcinoma.

Diagnosis of Tubal Diseases.

The most important among the diseases of the tubes are the inflammatory diseases, which are all due to infection. The structures are invaded by microörganisms from without, usually from the uterine cavity, more rarely the abdominal cavity; these lodge in the folds of the mucous membrane and produce a reaction which extends to the muscularis and the serous coat. The inflammatory products at the same time are deposited in the interior of the tube and, when the abdominal extremity closes up, accumulate and cause distention. Definition.

Depending on the kind of microörganisms, the degree and extent of the tissue reaction, and the age of the process a variety of clinical pictures are produced. As these frequently represent only different stages of the same disease, the development of one form from another can be directly seen if the patient is long enough under observation. For example, a recent gonorrheal infection of the tube produces a purulent salpingitis; as the accumulation of pus which results from closure of the abdominal extremity becomes more abundant, a pyosalpinx develops, and in the course of years, as the tissue reaction subsides and the pus becomes absorbed, a hydrosalpinx results. The disease may require medical intervention at any stage, and it is therefore necessary to resolve inflammatory tubal diseases into the individual clinical pictures which the physician is called upon to diagnosticate.

Inflammatory disease of the tubes occurs in the following forms:

Salpingitis.

Anatomic Picture. In catarrhal salpingitis the mucous membrane is swollen and the lumen of the tube is filled by its thickened folds. The muscularis is moderately infiltrated and only slightly thickened. Through the abdominal extremity the inflammation extends to the adjoining pelvic peritoneum and the serous covering of the tube itself, and produces adhesions between the abdominal extremity and the adjacent organs. The lumen contains moderate quantities of serous fluid. In purulent salpingitis the inflammatory processes are increased in severity. The swelling of the mucous membrane is much greater, and ulcers are sometimes present. The muscularis is extensively infiltrated and often as thick as the thumb. The infection travels from the tubal wall and out by the abdominal extremity to reach the serous covering of the tube, as well as the pelvic peritoneum, and leads to occlusion of the fimbriæ and adhesions with Salpingitis.

the organs that are in contact with the infected areas. In this way the tube becomes adherent to the omentum, intestines, bladder, uterus, and particularly the pelvic wall around the fimbriæ. Not infrequently the inflammation penetrates the connective tissue surrounding the tube and produces a circumscribed thickening. The lumen usually contains some pus, which may be serous, cheesy, granular or inspissated. In this way the normal tube becomes thickened and forms a cord which follows the normal course of the tube from the cornu of the uterus in a convex line downward and backward.

Diagnosis. While palpation of the normal tube is very difficult and possible only under favorable conditions of the abdominal walls, diseased tubes, owing to the thickening of their walls, are quite easy to feel. The examining hand is pressed firmly against the internal hand, so that the palpating fingers come in contact alongside of the uterus, and are moved up and down in a direction perpendicular to the course of the tube, when a cord of varying thickness will be felt rolling between the fingers. If the tube is very near the anterior pelvic wall, it may be difficult to bring the fingers together at that point; but if the uterus is elevated with the internal hand, thus bringing the tube nearer the abdominal wall, it will be felt with the external hand as a transverse cord immediately underneath the abdominal walls. In searching for the tube the hands must be kept near the cornu of the uterus because the tubes are hardest at that point, whereas near the abdominal extremity the cord is softer and its shape more indefinite; occasionally palpation of the uterine portion may be rendered easier by rolling it back and forth on the lateral aspect of the uterus as a base.

Palpation of the Tubes.

The palpatory findings in salpingitis vary, depending on whether the process is quite acute, or secondary changes resulting from inflammations are present. In acute conditions, owing to the greater tenderness of the tube and the peritoneal involvement, it is usually impossible to feel the tube itself, and the examiner must be content with localized tenderness in the tubal region; or possibly an indefinite, soft consistency with indefinable limits may be recognized. Hence the diagnosis in this stage is usually uncertain. After a certain interval, usually a few days, the tubes themselves can be felt and the inflammatory changes can be demonstrated by palpation. The changes vary according to the intensity of the inflammatory reaction.

In the mildest forms of catarrhal salpingitis the tube is but slightly thickened, often merely a little harder than a normal tube and somewhat painful on pressure. In chronic cases pain, occurring only at the instant when the tube is engaged between the palpatory fingers, is the only demonstrable sign. The greater the inflammatory reaction in the wall, the thicker and harder will be the cords. The

ovary may be found isolated in the arch formed by the tube or close to the abdominal extremity (Fig. 275). Adhesions are sometimes absent altogether or may be few in number and soft.

FIG. 275.—CATARRHAL SALPINGITIS. P.-F. ⅓. (Original.) The left tube contains a nodular swelling; both ovaries can be outlined; no adhesions.

In purulent salpingitis the objective changes are much more pronounced and the diagnosis is accordingly much easier. The tube, which is often as thick as the finger, is readily identified by its arching

FIG. 276.—PURULENT SALPINGITIS. P.-F. ⅓. (Original.) Right tube very tortuous; left tube drawn out and surrounded by adhesions at its abdominal extremity.

and slightly tortuous course. It is always easiest to feel the uterine portion of the tube, which begins at the cornu, because it is broad and thick and occasionally contains a few nodules; while the lateral portion, being filled with secretion and adherent to the pelvic wall and the ovary, is much less distinctly felt (Fig. 276). The consistency of the

tube is very hard and firm, and tenderness is rarely wanting, but depends in the main on the character of the accompanying inflammation. The outer convex outline is usually much more distinctly palpable than the inner, concave border toward the uterus, because the inflammation often extends from this point to the broad ligament, obscuring the latter, and also on account of the numerous adhesions with the uterus. The ovary can rarely be felt separately, but its position may be inferred if an isolated tumor is outlined alongside of the abdominal extremity of the tube. The diagnosis of tubal disease is rendered much more difficult by certain displacements of the uterus. In retroposition, for example, the fundus and tubes are placed so far backward that it is very difficult to differentiate them. Examination under anesthesia is often required. In retroversion and retroflexion it is almost never possible to feel every portion of the tube; the uterine portion, which is diagnostically most important, can be reached only by forcibly elevating the posterior vaginal vault. On the other hand, the club-shaped extremity, which is directed forward, can often be felt quite easily (Fig. 277). It may be possible by means of a rectal examination to recognize the tubal disease when the uterus is in retroflexion. Occasionally in retroversion only a part of the thickened tube is felt alongside of the uterus and identified as the tube by its cylindrical, finger-like shape.

Purulent Salpingitis.

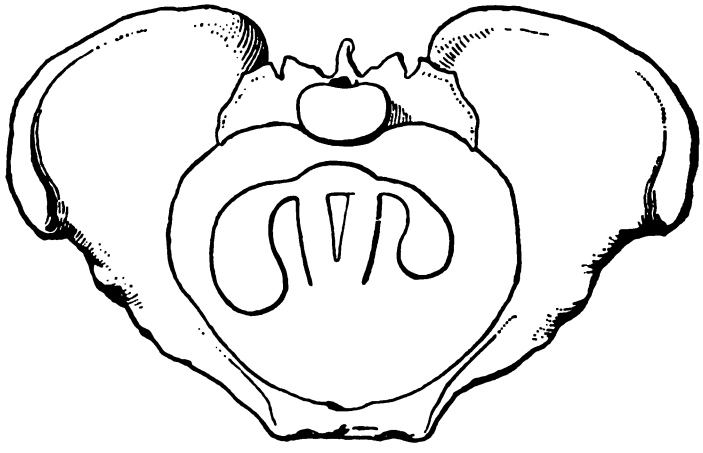


FIG. 277.—DOUBLE PYOSALPINX IN RETROVERSION OF THE UTERUS. P.-F. ⅓. (Original.)

Differential Diagnosis. If the swelling of the tube is at all distinct, it is hardly possible to mistake the diagnosis of salpingitis. The normal ovary must not be mistaken for the abdominal extremity of a thickened tube. If the ovary is spindle-shaped and gradually merges with the ovarian ligament, it may resemble a tube very closely; but as the

latter is inserted high up at the fundus, while the ovarian ligament is much lower down, the point of insertion can be determined by careful examination of the lateral aspect of the uterus; or the uterine portion of the tube, in which the changes are most distinct in every form of tubal disease, may be investigated.

Parametritic and perimetritic adhesions rarely give rise to errors, because diseased tubes are thicker and more round than adhesions and because the latter are usually multiple and do not present the characteristic course of the Fallopian tubes. Accumulations of

FIG. 278.—VARIOUS FORMS OF RETENTION TUMORS OF THE FALLOPIAN TUBE. ⅓. (From specimens in the Kgl. Universitäts-Frauenklinik in Berlin.)

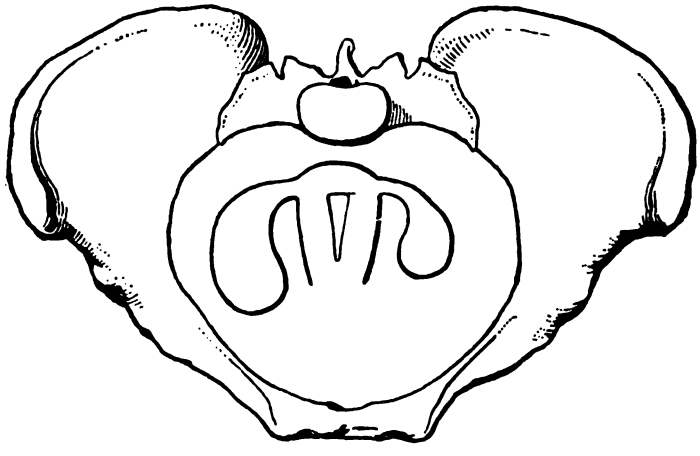
scybala in the sigmoid flexure, and sometimes even the empty gut, may be mistaken for a thickened tube on the left side, because the rows of scybala may simulate tortuosity and may occupy the situation of the tube. The sigmoid flexure, however, owing to the length of its mesentery, is always more movable than the tube; it is sometimes placed in front of the uterus; and the scybala, unless they are too hard, can be compressed and are not painful. Finally, the diagnosis can be assured by repeated examination, particularly after laxatives have been administered.

Retention Tumors.

When the abdominal extremity of the tube is occluded by perisalpingitic inflammation and the mucous membrane secretes inflammatory products, the latter accumulate in the lumen and distend the

tube is very hard and firm, and tenderness is rarely wanting, but depends in the main on the character of the accompanying inflammation. The outer convex outline is usually much more distinctly palpable than the inner, concave border toward the uterus, because the inflammation often extends from this point to the broad ligament, obscuring the latter, and also on account of the numerous adhesions with the uterus. The ovary can rarely be felt separately, but its position may be inferred if an isolated tumor is outlined alongside of the abdominal extremity of the tube. The diagnosis of tubal disease is rendered much more difficult by certain displacements of the uterus. In retroposition, for example, the fundus and tubes are placed so far backward that it is very difficult to differentiate them. Examination under anesthesia is often required. In retroversion and retroflexion it is almost never possible to feel every portion of the tube; the uterine portion, which is diagnostically most important, can be reached only by forcibly elevating the posterior vaginal vault. On the other hand, the club-shaped extremity, which is directed forward, can often be felt quite easily (Fig. 277). It may be possible by means of a rectal examination to recognize the tubal disease when the uterus is in retroflexion. Occasionally in retroversion only a part of the thickened tube is felt alongside of the uterus and identified as the tube by its cylindrical, finger-like shape.

Purulent Salpingitis.



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Retention Tumors.

When the abdominal extremity of the tube is occluded by perisalpingitic inflammation and the mucous membrane secretes inflammatory products, the latter accumulate in the lumen and distend the

tube. The abdominal portion of the tube has the greatest capacity and here the distention is accordingly greatest, while the uterine portion dilates but little and the interstitial segment rarely takes part in the distention at all. The thickness of the tumor wall is variable and determines the distensibility of the tube. If there is little infiltration, the wall yields readily and the distention is proportionately great.

FIG. 279.—HYDROSALPINX WITH OVARY. (Specimen from the Kgl. Universitats-Frauenklinik in Königsberg.)

Palpatory Findings.

The palpatory findings in retention tumors, which form the basis of diagnosis, vary according to the conditions present (see Fig. 278)—old processes with thin, watery contents (hydrosalpinx), more or less recent active processes with suppuration (pyosalpinx), or an accumulation of blood in the tube (hematosalpinx). For this reason these three conditions will be treated separately.

Hydrosalpinx represents a thin-walled tumor, which is usually filled with simple serous fluid. It has the following properties:

The shape of the hydrosalpinx depends in the main on the distribution of the contained fluid; as most of the contents accumulate in the abdominal portion, the typical shape of the hydrosalpinx is that of a club with a very thick extremity. Preformed tortuosities in the tube, with an abundance of folds in the lumen, may alter the shape by dividing the tube into separate portions; or, if they lead to complete occlusion, convert the abdominal portion into approximately round tumors contrasting sharply with the less distended uterine segment (Fig. 280). The shape is greatly influenced by the relations of the tube to the mesosalpinx, which is too short for the tube and, if the latter is distended with fluid, forces it to form tortuosities as in the case of the intestine and mesentery. The tortuosities usually occupy the median half, which is attached by a pedicle to the uterus and pelvic floor. In this way the characteristic convolutions of tubal tumors are produced (Fig. 278_1 and 278_2).

FIG. 280.—HYDROSALPINX WITH SACCULAR DILATATION OF THE ABDOMINAL EXTREMITY. (Specimen from the Kgl. Universitäts-Frauenklinik in Königsberg.)

In exceptional cases hydrosalpinx develops between the layers of the broad ligament. In such a case tortuosities are not produced (at least they cannot be felt as in the case of a freely movable tube), and the hydro-

salpinx represents an approximately round tumor with a fairly smooth surface, covered with peritoneum. If part of the contents is absorbed, the hydrosalpinx collapses and feels like a flat, ribbon-shaped structure.

The position of the hydrosalpinx corresponds in the main to the position of the normal tube. The uterine portion is always in its place, while the dilated fimbriated extremity lies deep in Douglas' space or in contact with the lateral or posterior surface of the uterus; in rare cases above, and adherent to the fundus. Most frequently the abdominal extremity is found in front of the sacro-iliac articulation, in the lateral portion of Douglas' space. Occasionally the tube is bent over forward and occupies the vesico-uterine excavation. Great variations in the position are possible if the mobility of the tube has not been abolished by adhesions. Intraligamentary tubal tumors are held near

FIG. 281.—INTRALIGAMENTARY HYDROSALPINX OF THE RIGHT SIDE. P.-F. ⅓. (Original.) The tumor cannot be differentiated from the uterus and is fixed by exudates at its base; above, the thickened uterine portion of the tube is distinctly felt.

the uterus by the broad ligament, usually fill out that structure, and lie close to the body. If they are large enough they push the free edge of the ligament upward and project above the fundus, but they rarely grow downward into the deeper portions of the parametrium.

The mobility depends on the degree of the accompanying pelvic peritonitis and its sequelæ. Sometimes the hydrosalpinx is as movable on its mesosalpinx as an ovarian tumor on its pedicle. If the broad ligament is relaxed, the mobility may attain a high degree. I once saw a hydrosalpinx the size of the fist, which could easily be pushed up as high as the costal arch. Often intraligamentary tumors may be quite movable if they do not involve the median portion of the ligament. Such cases are, however, exceptional. As a rule peritonitis occurs early and leads to adhesions around the abdominal extremity, which becomes fixed wherever it happens to be, at the lateral or posterior surface of the uterus, on the floor of Douglas' space, or at the pelvic wall.

The mobility of the tumor depends on the length and rigidity of the adhesions with the pelvic wall and with the parietal peritoneum; adhesions from contracting parametritic exudates are rare.

The consistency in hydrosalpinx is always distinctly cystic because the wall is thin and the fluid quite movable. It is only when the tumors are small, or surrounded by exudates, or adherent to the intestines that fluctuation is difficult to demonstrate. The rigidity of the tumor wall depends on the degree of distention. If part of the contents has been evacuated or absorbed, the tumor loses its cystic consistency and becomes flat and soft, and sometimes feels like a band.

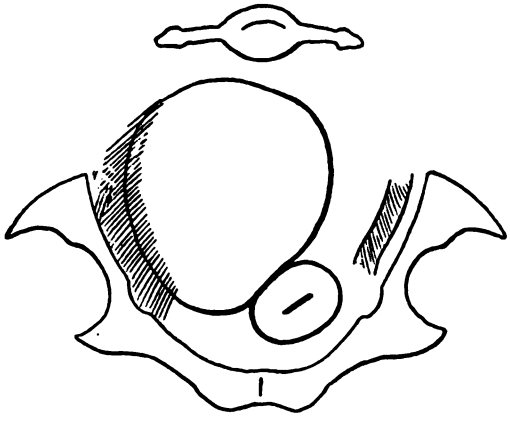

FIG. 282.—THE SAME IN HORIZONTAL CROSS SECTION. P.-F. ⅓. (Original.) On the right side the tumor is fixed to the pelvis by perimetritic adhesions. The posterior layer of the broad ligament has been pushed up, and the tumor is in contact with the posterior surface of the uterus. On the left side a section of flaccid tube is indistinctly palpable.

The tenderness which is present in tubal diseases is not due to the hydrosalpinx itself, but depends rather on the accompanying inflammation; in recent conditions it is usually intense, while it may be entirely absent in old cases.

Pyosalpinx results from the retention of large quantities of pus in suppurative salpingitis. As small quantities of pus cannot be demonstrated clinically, the term pyosalpinx is employed, as distinguished from purulent salpingitis, only when the abdominal extremity is distinctly dilated. In the main the features and peculiarities of pyosalpinx are the same as those of hydrosalpinx, modified, however, by the intensity of the inflammatory process and partly by the thickness of the wall. In general the tumors are much smaller, partly because a smaller quantity of pus is produced and partly because the thickened wall resists distention.

Pyosalpinx.

Shape. Marked tortuosity is much more rare in pyosalpinx because the thickened wall prevents it; if the distention is moderate, the tumor is usually club-shaped (Fig. 283), while in profuse suppurations it becomes spherical. The shape of an intraligamentary pyosalpinx is absolutely spherical. The tumor is surrounded by the inflamed and thickened layers of the broad ligament, and the characteristic tubal outline is entirely lost.

The position in pyosalpinx is always more constant than in hydrosalpinx because of the many adhesions and early occurrence of fixation. If the uterus is in its normal position, the pyosalpinx usually

corresponds to the regular course of the tube, with the abdominal extremity directed backward and downward. The latter is almost always at the posterior pelvic wall, sometimes high up, but usually low down in Douglas' space or at the lateral aspect of the uterus.

Cystic consistency and fluctuation can be demonstrated only in large tumors. On account of the thickness of the wall and surrounding exudates, moderate quantities of pus cannot be recognized. In most cases of pyosalpinx the consistency is hard and unyielding, except at the abdominal extremity, where the tumor is somewhat softer.

The mobility in pyosalpinx also depends on the extent and firmness of the adhesions. Absolutely movable pyosalpinx without any adhesions is rare; as a rule the abdominal extremity is early sur-

FIG. 283.—RIGHT-SIDED PYOSALPINX. P.-F. ⅓. (Original.) Club-shaped pyosalpinx, separated by exudates from the lateral surface of the uterus.

rounded and firmly fixed to the posterior pelvic wall by dense adhesions, while the anterior segment together with the uterus may retain its normal mobility. If extensive pelvic peritonitis is superadded, the entire tube becomes enveloped in adhesions to the uterus, parietal peritoneum, bladder, rectum and ovaries, gradually limiting the mobility or abolishing it altogether if the pelvic adhesions are sufficiently broad. As a result of parametritic exudates the tumor may be firmly cemented to the pelvis (Fig. 284); this is particularly the case with intraligamentary pyosalpinx.

The tenderness in pyosalpinx depends chiefly, but not exclusively on the accompanying pelvic peritonitis; in recent cases it is very intense, while in old, chronic cases it may be entirely absent.

Hematosalpinx, or the accumulation of hemorrhagic fluid in an occluded tube, occurs in connection with hematometra in atresia of the genital organs, or from hemorrhage into a hydrosalpinx the result of torsion or traumatism. Accumulation of pure blood in the gravid

tube is not included in the present discussion (see p. 146). Hematosalpinx has nothing characteristic and closely resembles hydrosalpinx, because the inflammatory process is mild, whether it be causal or merely secondary. If the distension is great, or if pure blood is coagulated in the tube, the consistency is usually very much harder.

Diagnosis.

The diagnosis of a tubal tumor is based on the finding of a tumor alongside of the uterus and separated from it; the tubal origin of the tumor is recognized by the above-described properties.

The shape of a hydrosalpinx may be sufficiently characteristic to establish the diagnosis by itself. The sausage-shape should be noted

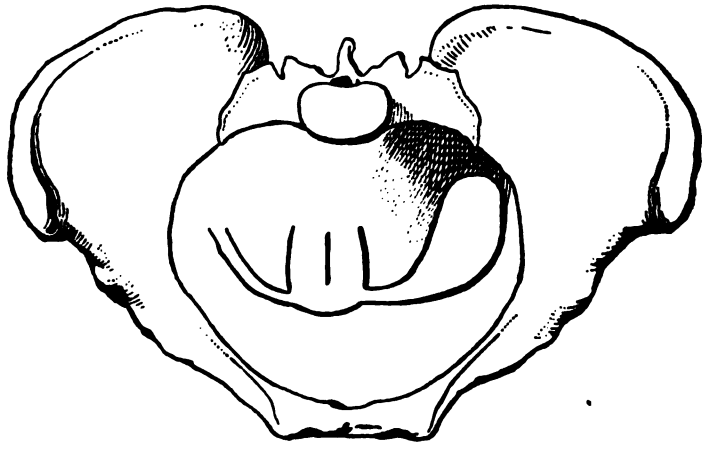

FIG. 284.—LEFT-SIDED PYOSALPINX, with a parametritic exudate under the abdominal extremity. P.-F. ⅓. (Original.) The right tube is somewhat thickened.

and tortuosities looked for in the uterine portion. Sometimes the individual portions of the tube are represented by so many nodes lying side by side. The tortuosities that are directed toward the abdominal walls are particularly easy to recognize as the outer fingers pass over them, while those directed downward are more apt to be inaccessible to palpation. Sometimes the tortuosities of the uterine extremity lie on top of the dilated abdominal extremity (Fig. 278_1) as in the case of an ovarian cyst. If the convolutions of the tube are close together they cannot be made out by palpation, and all that can be felt is a few constrictions on the surface of the roundish tumor. When the tumor is intraligamentary, its characteristic shape is obscured by the peritoneal investment. If the hydrosalpinx is adherent to the uterus it also represents merely a roundish tumor, sometimes difficult to differentiate and without any characteristic shape, which is completely obscured by the adjacent ovary, the surrounding exudates, and

Diagnostic Features.

adhesions with the intestines. Pyosalpinx is recognizable by its shape only if the tumor is more or less cylindrical, with a club-shaped extremity; tortuosities are more rarely felt. The shape is often completely obscured by perimetritic adhesions and parametritic exudates around the abdominal extremity. If the tumor is between the layers of the broad ligament or adherent to the uterus, it resembles an approximately round or oval tumor and is in no wise characteristic.

The position of the tumor may reveal its tubal origin if it corresponds to the course of the tube, especially if the main tumor occupies the site of the infundibulum in the lateral portion of Douglas' space.

Mobility and consistency are not pathognomonic of tubal tumors.

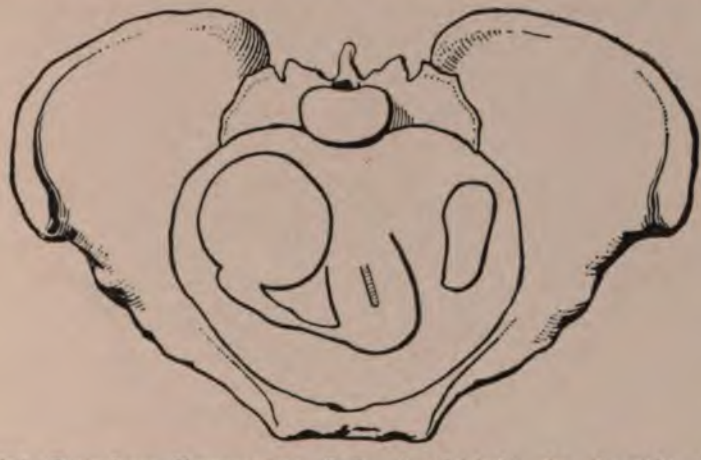

FIG. 285.—RIGHT-SIDED HYDROSALPINX. P.-F. ⅓. (Original.) On the right, the thickened tubal cord is distinctly palpable, the outer extremity merging with the tumor. On the left, a section of sausage-shaped, flaccid tumor is palpable.

In addition to the above properties, which may occasionally suffice to establish the diagnosis, there are certain other signs of very great value.

A thick cord running from the cornu of the uterus to the tumor is an invaluable sign of tubal tumor. The cord is the infiltrated and non-dilated uterine portion of the tube, which is so constant in inflammatory tubal tumors because the inflammation begins in the uterus and first attacks this portion of the tube. The greater the infiltration the more distinctly will the cord be felt. In old cases of hydrosalpinx the tubal wall may become so thin from absorption that it can no longer be felt. The cord is felt most distinctly when the uterus is raised from within, and the examining hand is passed up and down in the anteroposterior direction alongside of the cornu of the uterus. The lateral portion is usually more indistinct and merges with the tumor, or may be traced for a certain distance on the tumor wall (Fig. 285). The cord is quite distinct even when the tumor is intraligamentary (Fig. 281). It is particularly important to demonstrate this

Tubal Cord.

tubal cord when the entire tube, along with the ovary, intestines, bladder and peritoneal cysts, forms an indefinite tumor. I regard thickening of the uterine portion of the tube as the most reliable sign of a tubal tumor.

The fact that the disease is bilateral is a very important diagnostic feature because in almost every case both tubes are attacked at the same time or in rapid succession. An absolutely uninvolved tube on one side when the other tube is the seat of distinct alteration is a pathologic curiosity, and clinically also it is far more frequent that both sides are distinctly involved. One must not of course expect to find the same kind of tumors on both sides; this occurs only in a limited number of cases. Frequently the intensity and extent of the process vary on the two sides and the alterations are accordingly different. Pyosalpinx of one side may be associated with hydrosalpinx of the other. Well marked retention tumors with purulent or catarrhal contents on one side may be associated with salpingitis on the other. In fact, the mere finding of an indistinct thickening of the adnexa, or fixation localized chiefly at the cornu of the uterus, or pain limited to the region of the adnexa, on one side, when there is a tumor on the other, is enough to characterize the condition as bilateral and is an argument in favor of the tubal origin of the tumor. If there are several large tumors side by side in Douglas' space, it may be difficult to determine whether they form one or two masses; in the latter case a distinct furrow is usually made out, or, if the greater portion of the tumor is near the pelvic wall, it becomes smaller toward the median line. It is to be observed that this sign is only of limited value, as ovarian tumors of other kinds are not infrequently bilateral. Myomata even may be present on both sides of the uterus, exudates may be bilateral; but tubal disease is by far the most common bilateral condition that occurs in the adnexa.

Bilateral Distribution.

Perimetritic and parametritic inflammations play an important rôle in the diagnosis of tubal diseases because the infection almost regularly spreads from the tube to the pelvic peritoneum and occasionally also to the parametrium. Acute peritonitis should arouse the suspicion of a tubal disease, especially if it represents a recurrence. Although the accurate demonstration of a diseased tube may be impossible during the acute stage of pelvic peritonitis, pain localized near the adnexa is always strongly suggestive of tubal disease. After the acute stage has run its course, there remain indistinctly palpable, extremely sensitive tumors in the region of the adnexa, which consist of the tubes, the swollen ovaries, adherent coils of intestine, and small peritoneal cysts. The shape of the tube is more distinct in proportion to the duration of the process, and around the tube there remain numerous adhesions

Perimetritic and Parametritic Inflammations.

with the adjacent organs and the pelvic wall, especially at the abdominal extremity. Parametritic inflammation occurs chiefly with purulent salpingitis and, in the acute stage, leads to the production of painful exudates underneath the tube, especially the fimbriæ, and ultimately to parametrial cicatrization in the form of a diffuse, cord-like thickening. In these various stages pelvic peritonitis, and more rarely parametritis, is an almost regular concomitant of tubal disease, and, if it is localized in the region of the adnexa, is a strong argument in favor of the tubal origin of an otherwise doubtful tumor; for, although inflammatory complications occur with ovarian tumors, hematomata and myomata, they are by no means so frequent nor so extensive as in the case of tubal tumors. The complicating pelvic peritonitis sometimes takes the form of so-called adnexal tumors, which present considerable diagnostic difficulties. These adnexal tumors in the narrower sense of the term, in contradistinction to the typical retention tumors, are small

Fig. 286.—Fundus of Uterus with Bilateral Purulent Salpingitis.

formations near the upper portion of the uterine body, consisting of the thickened and coiled up tube, the inflamed and enlarged ovary, adherent omentum and intestinal coils, and small masses of exudate among the peritoneal adhesions. These structures are so matted together that it is impossible to differentiate the individual constituents of the mass by palpation, and its tubal origin can only be inferred. When the altered adnexa are inaccessible to palpation they cannot be differentiated even by the most careful examination. Whereas in the normally situated uterus the adnexal tumor may be recognized as tubal by the thickened uterine extremity of the tube, which is distinctly palpable, all that one obtains by physical examination when the uterus is in retroposition or retroflexion is a general impression of a tumor of the upper portion of the adnexa. The bilateral character, the tenderness, the many adhesions with surrounding structures, the semi-soft consistency are sufficient to characterize the tumor as tubal.

The presence of gonorrheal catarrh may indicate the diagnosis of tubal tumor because gonorrhea is the most frequent cause; if gonorrhea cannot be definitely demonstrated in the woman, the presence of the disease in the husband is equally suggestive.

The diagnosis may also find some support in the history of the case, which may suggest the inflammatory character of the tumor. If it is learned that the tumor is the result of an old pelvic peritonitis, it is reasonable to suspect a tubal tumor; or, if the woman states that the attacks of pelvic peritonitis recur from time to time and that she feels well or at least better during the intervals—in other words that the pelvic peritonitis is of a relapsing type—the tumor is very probably a gonorrheal pyosalpinx. The statement that the disease began soon after marriage heightens the suspicion of infectious tubal disease.

Anamnesis.

The symptoms are never sufficiently characteristic to establish the diagnosis, although recurrent attacks of pain distinctly localized in the side are very probably due to tubal disease.

Exploratory puncture is a diagnostic procedure which can and ought to be replaced by accurate palpation. Even with antiseptic precautions it is not without danger, as it may cause infection and suppuration of an aseptic tumor or evacuation of part of the contents of a pyosalpinx into the abdominal cavity. As in addition the fact that blood, serous fluid, or even pus is obtained gives no positive information as to whether the material was inside or alongside of the tube, the results of exploratory puncture add nothing to the accuracy of the diagnosis. The procedure should therefore be abandoned except for the purpose of examining the pus in order to determine the variety of microörganisms present (see p. 67).

Exploratory Puncture.

Differential Diagnosis.

A number of conditions must be considered in the differential diagnosis of retention tumors, depending on whether we have to deal with a distinctly cystic hydrosalpinx or a hard, thick-walled pyosalpinx.

Hydrosalpinx is most frequently confounded with cystic ovarian tumors. The physical signs in the two conditions may be quite similar. Even after the abdomen has been opened, it may be impossible to make out the origin of the tumor by inspection; but the differential diagnosis is especially difficult when the tumor is intraligamentary, and neither its shape nor its connection with the uterus can be distinctly made out. An attempt must always be made to find the thickened uterine portion of the tube. The fact that the tumor is bilateral and the presence of inflammatory processes in the neighborhood are also in favor of tubal tumor. The diagnosis is easier when the hydrosalpinx is free and pedunculated; whereas an ovarian tumor is always round or oval and freely movable, or at most held fast by a few adhesions at the base, hydrosalpinx in most cases, although not always, presents the familiar cylindrical, tortuous or club-

Ovarian Tumors.

shaped outline and is usually attached to all the neighboring structures by numerous perimetritic adhesions. The examiner should always try to palpate the tube. In the case of an ovarian tumor it is often found normal in length and thickness, lying in front of the tumor; while in hydrosalpinx the uterine portion is thickened and the lateral extremity merges gradually with the tumor wall. On account of the many adhesions it is usually impossible to feel the ovary alongside of the hydrosalpinx. The above-mentioned historical data and the demonstration of gonorrhea occasionally help to establish the tubal character of the tumor.

The diagnosis between hydrosalpinx and parovarian cyst may be still more difficult because of the impossibility of outlining the tube and the fact that the ovary is sometimes distinctly felt alongside of the tumor.

For a differential diagnosis between hydrosalpinx and encapsulated peritoneal exudates, see the latter.

Pyosalpinx. Failure to recognize this as a tubal tumor is much more common on account of the thick wall of the pyosalpinx. Pyosalpinx is easily mistaken for a solid tumor. For instance, a pyosalpinx with a greatly infiltrated wall and a small quantity of pus in its interior may be mistaken for a pedunculated subserous myoma, especially if the tube is coiled up and hidden under masses of exudate, or the tumor is intraligamentary. The myoma can be recognized only on careful palpation by its round shape, free mobility and the absence of pain; while the outline of a tubal tumor is more vague on account of the surrounding exudates; palpation is painful; and the tumor is usually firmly adherent to the neighboring structures. The presence of two symmetrical tumors, one on each side, is also in favor of a tubal origin. The peduncular attachment to the uterus is different in the two conditions. In pyosalpinx the pedicle is thin and merely connects the cornu of the uterus with the tumor, while the remaining portion of the tumor is in relation with the outer surface of the uterus and can be separated from it. In subserous myoma, on the other hand, the peduncular connection is much broader, as a large portion of the periphery of the tumor is in the uterine wall. Leukocytosis is a valuable auxiliary in the diagnosis of the individual forms of pyosalpinx. The data obtained from the history may also assist in the differential diagnosis, as has been explained. In these cases also exploratory puncture, although an easy method of distinguishing between a solid and a pus-containing tumor, should be avoided on account of its dangers.

Subserous Myoma.

For the differential diagnosis between pyosalpinx and parametritic exudates, see the latter.

Tubal pregnancy for obvious reasons may produce conditions closely resembling those of inflammatory tubal disease, especially tubal mole or retention of a dead ovum with hemorrhages in the lumen,

the physical signs of which are often indistinguishable from those of purulent salpingitis or pyosalpinx. If it is remembered that tubal pregnancy frequently develops on the foundation of an inflammatory tubal disease and, on the other hand, that inflammatory conditions may result from imperfect absorption of the tubal pregnancy, it is no wonder that the diagnosis is absolutely impossible in many cases of long standing. In recent cases, on the other hand, the differential diagnosis may be said to be possible for the following reasons: If the tube is greatly distended with clotted blood, the tubal mole is usually much harder than a pyosalpinx; while, owing to the absence of extensive inflammation, there is a total freedom from adhesions and the tumor is practically painless. A characteristic feature of tubal pregnancy is that the uterine extremity of the tube is not involved unless, in exceptional cases, implantation has taken place near the uterus; whereas in the presence of inflammatory tubal disease the tube is characteristically thick and hard. If it can be absolutely demonstrated that the other side is not involved, tubal pregnancy is much more probable than inflammation. Pedunculated tubal hematocele, and occasionally a laterally situated retro-uterine hematocele, may be mistaken for hydrosalpinx on account of the cystic consistency, at least in the early stages. A thin wall, uniform consistency and distinct fluctuation are all in favor of hydrosalpinx; whereas in hematoma no distinct wall can be palpated, the tumor merging with the neighboring structures; the consistency is variable; and, above all, there is a gradual hardening as coagulation takes place. Under these circumstances also the character of the uterine extremity of the tube may establish the diagnosis. Whenever tubal pregnancy has to be distinguished from tubal inflammation, the historical data described in these two affections play an important part.

Tubal Pregnancy.

The differential diagnosis between the right-sided tubal disease and perityphlitis or appendicitis is of the greatest practical importance. Errors in both directions are very frequent. Owing to the constantly increasing importance of appendicitis in recent years, the diagnosis of this condition is unquestionably made too often. The source of error resides in the spatial proximity of the two organs, and particularly in the fact that the two processes are interdependent and often associated. An adherent appendix may infect a tube, or the latter may become involved in a contiguous perityphlitic exudate. Conversely, appendicitis may develop secondarily when the appendix becomes adherent to the diseased tube, and a perisalpingitic process may extend to the cecum. The symptoms of the two conditions also may be very similar, since recurring attacks of peritonitis with acute onset and continuous pain in the affected side

Perityphlitis.

are characteristic of both. Hence, unless distinct intestinal symptoms such as colic, symptoms of stenosis or, on the other hand, gynecologic symptoms such as hemorrhage, vaginal discharge or dysmenorrhea are decisive one way or the other, but little may be expected from the symptomatology in the differential diagnosis between the two conditions. It should, if possible, be made by means of an objective examination. By external examination the seat of the exudate should first be determined. If it is found on the iliac bone, or possibly the infiltrated and tender appendix can be directly felt in that region, the diagnosis of typhlitis or appendicitis is practically certain, provided the genitalia are later found to be uninvolved. Pain on pressure alone must be interpreted with great caution because forcible depression of the abdominal wall at this point is equally painful in uncomplicated genital affections. Bimanual examination will often at once clear up the diagnosis in simple cases if the tumor is felt entering the pelvis from above, while the origin of the tubes is free; or, conversely, if the tumor is distinctly localized in the tube and the other adnexa are possibly also diseased. Difficulties are encountered in those cases in which the intestinal exudate approaches the genitalia, or *vice versa*. In such cases the starting point of the morbid process may sometimes be recognized by the course or by the site of the centre of the exudate. Combinations of the two processes, even when they are not interdependent, present difficulties when an intestinal inflammation is superadded to an old genital disease, or *vice versa*. One is always inclined to attribute the new symptom to the old process, and repeated accurate local examination is the only means of guarding against a mistake in diagnosis.

Diagnosis of Certain Special Conditions.

After the diagnosis of inflammatory tubal disease has been established, the etiology remains to be determined. Aside from the scientific interest, this question is important to the practitioner because the prognosis and treatment are materially influenced by the variety of microörganisms which has produced infection and by the specific tissue reaction.

Of the microörganisms that are capable of producing tubal disease the following have been found in the tube: gonococci, tubercle bacilli, streptococci, staphylococci, pneumococci and actinomyces. The frequency of the most important varieties is determined by examination of the pus obtained from tubal sacs, as shown in the following table.

	Sterile.	Gonococci.	Tubercle Bacilli.	Streptococci.	Staphylococci.
Wertheim II. (114 cases)	57	39	.	11	5
Menge (112 cases)	75	28	9	4	1
Witte (39 cases)	24	7	.	4	2

Although these results, with regard to tubercle bacilli especially, show marked differences, it is nevertheless evident that gonorrhea is by far the most frequent cause, when it is remembered that gonococci are rapidly destroyed and that the great majority of cases in which pus is reported as sterile are also gonorrheal.

Gonorrhea, tuberculosis and septic salpingitis are the only conditions that have any practical importance. In most cases the differential diagnosis between these three varieties is possible and is based, first on the objective examination and, second, on the symptoms and the course of the disease. If these means fail, a bacteriologic examination of pus obtained by aspiration may be made in particularly important cases.

Since gonorrheal salpingitis is by far the most frequent form of tubal inflammation, being present in from 80 to 85 per cent. of all cases, it may be assumed unless there are definite reasons for suspecting some other form of infection. On examination the tubes show nothing characteristic to distinguish this from the septic form, while tuberculosis can often be differentiated from either. If extensive parametritic exudates are found underneath the tube, the condition is probably not gonorrheal. Small exudates may be present with gonorrheal pus-tubes. If gonorrhea is positively demonstrated in the lower portions of the genitalia, particularly the uterus, tubal disease may be attributed to the same cause with a fair degree of probability; but if no signs of gonorrhea are found in the uterus, gonorrheal pyosalpinx must not be excluded on that account, as the disease tends to subside in the mucous membrane and infection in the uterus may be present without producing any symptoms. Useful information is usually obtained from the history. If the salpingitis develops after menstruation, and especially a short time after the beginning of marital intercourse, the condition is very probably gonorrheal. Gonorrhea in the husband is also an important diagnostic point.

The septic form, which is due to infection with staphylococci and streptococci and may be estimated as representing from 5 to 10 per cent. of all cases, is difficult to diagnose on account of the paucity of the physical signs, among which I may mention the presence of extensive parametritic exudates associated with protracted fever that can only be referred to the tubes. As a rule fever of a few days' duration occurs only at the beginning of a gonorrheal infection or recurs with subsequent exacerbations, while in septic salpingitis, possibly owing to the constant production and absorption of fresh toxines, the fever may continue for months and may return again and again at the time of menstruation. But little information is obtained from the history. The fact that the tubal disease followed infection during the puerperium is not diagnostic, because gonorrhea very frequently appears in the tube during the puerperium. The same thing applies to salpingitis developing after curettage and sounding of the uterus or uterine treatment of tubal infection, because these manipulations also permit extension of the gonorrheal process to the tubes.

Tuberculous salpingitis is so well characterized by its symptoms, course and physical signs that the diagnosis is usually possible. The incidence may be estimated to be about 5 per cent. The condition of the tubes themselves is not particularly characteristic. As tuberculosis is accompanied by marked infiltration of the walls and suppuration, if it occurs at all in typical form, develops late, the tubes are found very much infiltrated, and somewhat rough or nodular if infantile tortuosities are also present. If the infection is derived from the uterus, the nodes are most distinct in the uterine extremity. If pyosalpinx develops, these signs are not present. As tuberculosis is either derived from the peritoneum or extends to that membrane, signs of peritoneal disease in the form of ascites or peritoneal nodules (see p. 472) are almost regularly present. The combination of ascites and swelling of the tubes is an almost positive sign of tuberculosis; for, although ascites also results quite frequently from neoplasms of the tube, that condition is extremely rare. Signs of tuberculosis in the genitalia, such as tuberculous ulcers or tuberculous endometritis, confirm the diagnosis. The presence of tuberculosis in other organs renders the diagnosis very probable; hence the lungs, the bones, the joints, the intestines and the skin must also be investigated. In one case the diagnosis was suggested to me by lupus of the face. The symptoms and the patient's general condition are of very little value. Doubtful cases may be cleared up by resorting to the tuberculin reaction. Heredity and the history of previous scrofula and tuberculosis are the only factors of value in the history. Exploratory puncture for the purpose of clinching the diagnosis by an examination of the pus is dangerous and should be employed only when in a serious case an important therapeutic intervention, such as incision of a septic pyosalpinx, depends on the result of the examination. As in more than half of all the cases, particularly when the process is old, the pus is sterile, the results of exploratory puncture are of very little real value.

Prognosis and the treatment to be employed in an individual case may depend on the contents of the tubal tumor; in other words, it is often important to differentiate between the three kinds of retention tumors. Hydrosalpinx can sometimes be distinguished from pyosalpinx by palpation, although it must be remembered that the change from one to the other is gradual. Thin walls, fluctuation, mobility, marked tortuosities are in favor of hydrosalpinx; while pyosalpinx is usually small, harder, attached by a broad base, associated with exudates, and often more sensitive on pressure. Hematosalpinx can be diagnosed with some degree of certainty only when the most common cause, occlusion of some of the lower genital segments, is demonstrable; the history of a pre-

Contents of Retention Tumors.

vious tubal pregnancy is also suggestive, but not positive evidence of hematosalpinx. Leukocytosis affords a valuable means of recognizing the most important contents of the tubal tumor, namely pus.

It has been shown by Dützmann, Pankow and others, who have made systematic leukocyte counts and confirmed the diagnostic significance of the sign by the results of operations, that a distinct leukocytosis is almost always present in suppurative salpingitis. On the other hand, the actual number of leukocytes is smaller than in the case of recent abscesses and, as a rule, does not exceed, nor fall much below 15,000. The reason probably is that after the acute process has run its course, leukocytosis slowly subsides on account of the death of the microörganisms, although the pus still persists. Hence a comparatively low leukocytosis demands consideration in the diagnosis. According to Pankow's results a persistent leukocytosis of 15,000, provided of course every other cause has been excluded, indicates pus; but a count of less than 10,000 does not exclude its presence. The low figures may be in part also attributable to gonorrhea, which, on account of its local character, produces a considerably lower leukocytosis. In 10 cases of tuberculous pyosalpinx examined by Dützmann and Pankow leukocytosis was constantly absent, while in streptococcal infections large numbers of leukocytes were always found.

On the strength of these observations leukocytosis may be utilized with certain reservations for the diagnosis of pus in tubal disease; indeed it almost seems to afford a means of differentiating the various forms of pyosalpinx.

Exploratory puncture is of course a very reliable means of determining the contents of a tumor, but it should be employed only after all other means have failed and when the question of operaton depends on the result.

Diagnosis of Perforation.

Perforation of a pyosalpinx is a bad complication because it produces a cavity which constantly secretes fetid pus, and not only occasions great annoyance to the patient but seriously undermines her health. The diagnosis of existing and impending perforation is therefore not without importance. Perforation may take place into the rectum, bladder, vagina, or to the outer air through the abdominal walls. As perforation is always preceded by the formation of large exudates, through which a communication with the respective hollow organ by means of a fistula is established, the tubal tumor loses its characteristic shape and becomes surrounded by large, usually parametritic, masses of exudate, which bind the tumor to the hollow organ into which rupture has taken place. The first sign of perforation is the discharge of pus with the feces or urine, into the vagina or through an opening in the abdominal wall; the flow is usually abundant and the pus has a penetrating odor. The fistula in the abdominal walls or in the vagina, where it is readily detected between the folds of mucous membrane by the infiltration at the base and purulent discharge from the fistular orifice, must be sounded, and the direction of the sound with respect to

the tube noted. The opening of the perforation into the rectum is sometimes so small that it cannot be felt, but it is always found at the point where the exudate is closest to the rectal wall. Perforation into the bladder is recognized with the cystoscope.

In a case of this kind Kolischer found a cleft-shaped opening surrounded by fringed edges, from which there projected a small, yellowish, sausage-shaped mass, grooved in the longitudinal direction, which became elongated as the adnexal tumor was compressed, causing the pus to separate and deposit itself on the floor of the bladder.

The diagnosis of perforation in pyosalpinx is accordingly based on the presence of a tubal tumor and the discharge of pus from an organ to which the tumor is attached by a broad base. The differential diagnosis from perforation of an exudate is based on the fact that the tumor has a round contour and on the fetid odor of pus, indicating that it has been retained for some time in a large sac.

The diagnosis of impending perforation is suggested by the presence of an exudate which is approaching the corresponding organ, and by marked febrile movements. This preparatory stage gives rise to characteristic changes in the abdominal walls, the vagina, the rectum and bladder, which will be described in connection with abscess formation in parametritic exudates (p. 495).

Neoplasms of the Fallopian Tubes.

Neoplasms of the tubes are very rare. The benign formations that have been observed are papilloma and fibroma. Among malignant neoplasms may be mentioned carcinoma, sarcoma, and chorio-epithelioma. The only ones that are frequent enough to have any practical significance are papilloma and carcinoma. Tubal Neoplasms.

Papillomata are as a rule unilateral neoplasms of the tubal mucous membrane, developing on an inflammatory base. The newly formed masses fill the interior of the tube and may produce tumors of considerable size. The papillomatous folds, like uterine papillomata, secrete a serous fluid which either collects as freely movable ascites in the abdominal cavity or, if the abdominal extremity of the tube is closed, escapes from the uterus. As these tumors originate in chronic inflammations, a tentative diagnosis may be based on the observation of increased growth in chronic adnexal tumors, with the production of ascites and an intermittent flow of serous fluid from the uterus (hydrops tubæ profluens).

The physical signs in carcinoma are the same as in papilloma, and the malignant nature of the tumor may be suggested by the greater age of the patient and the presence of cachexia.

The diagnosis of these two neoplasms is exceedingly difficult.

Diagnosis of Pelvic Peritonitis.

(Pelveoperitonitis.)

Pelvic peritonitis is inflammation of those portions of the peritoneum the parietal layer of which forms the covering of the upper portions of the true pelvis, the iliac bones, and adjacent portions of the anterior and posterior abdominal walls; while the visceral layer invests the uterus, tubes, base of the ovaries, bladder and anterior portion of the rectum and forms the broad ligaments on each side of the uterus (see p. 82). In addition to pelvic peritonitis we commonly use the term perimetritis to designate inflammation of the serous covering of the uterus (although the term is generally used to include inflammation of the entire pelvic peritoneum in contradistinction to parametritis), perisalpingitis for inflammation of the serous covering of the tubes and their immediate neighborhood, and perioöphoritis for inflammation of the structures surrounding the ovary.

Definition.

Pelvic peritonitis may be a concomitant of general peritonitis originating in some of the abdominal organs, as after perforation of the stomach, intestines or gall bladder; such cases are not included in the present discussion. The gynecologist is chiefly interested in those forms of peritonitis which follow diseases of the pelvic organs, and which may either gradually spread to the entire peritoneum with the production of diffuse or general peritonitis, or confine themselves to the region of the true pelvis and its immediate neighborhood. A distinction ought therefore to be made between general and circumscribed peritonitis; but as in the case of the former the inflammation may subside in the peritoneum generally and the pelvic inflammation which remains as a residuum may be identical with the pelvic peritonitis originating in the pelvis, the distinction is very difficult and can usually be made only at the height of the morbid process.

Diffuse Peritonitis.

Diffuse peritonitis beginning in the genital organs usually originates in the true pelvis and extends to the entire abdominal cavity. When it is caused by large tumors of the ovaries and uterus it rarely develops primarily in the upper portion of the abdominal cavity. The cause is either infection of the abdominal cavity with microörganisms or some as yet ill understood chemical or mechanical influence. A knowledge of these two etiologically distinct forms is very necessary, as they produce clinically different pictures.

I. **Non-infectious peritonitis** results from rupture and torsion of ovarian tumors; it accompanies papillary cysts and nutritional disturbances in cases of myoma and ovarian tumor; the condition is seen most characteristically in torsion of the pedicle. In this form the symptoms are limited to the abdomen and the general phenomena peculiar to the septic form are absent. There are meteorism, moderate tenderness, occasional vomiting, and a sluggish action of the bowels; while the pulse, temperature and general condition show no change. Not infrequently the local phenomena are absent, and at the operation very marked changes, which may be much more pronounced than in septic peritonitis, are unexpectedly found. Hence the diagnosis cannot always be made; it is easiest when the above-mentioned symptoms develop in a case of tumor. The distinction from ileus is not always possible. Non-infectious peritonitis is much more frequently local and leads to the formation of adhesions in the case of tumors, encapsulation of blood and extrauterine gestation sacs, uterine and ovarian adhesions, particularly in the presence of displacements (see p. 254).

II. Infectious peritonitis. Depending on the microörganisms present we distinguish:

1. **Septic Peritonitis.** This is caused by infection of the abdominal cavity with streptococcus and staphylococcus pyogenes, less frequently pneumococcus and bacterium coli, after an abdominal section; by rupture of a pyosalpinx, suppurative dermal cyst, gestation sacs, and hematoceles; and by perforation of a necrotic carcinoma.

A further subdivision of infectious peritonitis in accordance with the causal septic microörganism into streptococcus peritonitis, bacterium coli peritonitis, etc., for clinical purposes is as yet impossible.

The clinical picture on which the diagnosis is based is made up of local signs of irritation and the symptoms of general sepsis. The former consist in meteorism, singultus and the formation of an exudate; the latter in irregular heart action and loss of strength. The diagnosis presents no difficulties when all the symptoms, or at least the most important ones are present; but this is rarely the case, and any one of the cardinal symptoms may be wanting. The most constant, as well as the most important is meteorism, which may occur in any degree of severity from a barely perceptible increase in tension to extreme, drum-like distention of the abdomen. Meteorism subsides with every temporary diminution of the inflammation and increases again with every exacerbation; it is therefore the most valuable diagnostic and prognostic sign of peritonitis. Tenderness on pressure is much less important, as it may be entirely absent in slowly progressive cases with abundant exudate, and in cases of very severe septic inflammation. Vomiting is almost always present in diffuse

septic [illegible] black, liquid masses usually in small quantities [illegible] without effort at short intervals. The most inconstant [illegible] symptoms is the presence of a clinically demonstrable [illegible] In protracted cases, however, small movable masses of [illegible] may be recognized in the lumbar regions. Occasionally a large, [illegible] collection, as in ascites, may be found.

[illegible] the general symptoms the most valuable is the increase [illegible] frequency of the pulse-rate. It is never absent and [illegible] the first sign of beginning inflammation. In the severe septic [illegible] the pulse increases very rapidly and becomes small and irregular; [illegible] milder forms the acceleration is much less. Fever is a much [illegible] inconstant symptom. It may be entirely absent or very slight [illegible] the gravest cases that rapidly terminate in death. In other cases the [illegible] is moderate and rarely attains an excessive height. The course is [illegible] characteristic. The general appearance of the patient, especially the facial expression, may be so characteristic as in itself by mere inspection to suffice for diagnosis as well as prognosis. Restlessness, an anxious expression, wide open eyes and distorted features make up a picture which is absolutely typical of peritonitis.

2. **Tuberculous peritonitis** usually attacks the entire peritoneum and leads to the secretion of a serous exudate and the eruption of tubercles in the entire abdominal cavity (peritonitis tuberc. adhæsiva). Tuberculous ascites in most cases is fluid and freely movable; in other cases the fluid becomes encapsulated between the intestinal coils and the abdominal wall, producing flat cystic tumors of irregular outline and surrounded by adherent coils of intestines. In rare cases the two layers of the peritoneum become adherent without the production of a fluid exudate, and the mesentery and omentum contract and become shortened. Quite frequently a transverse area of resistance is found above the umbilicus, which corresponds to the adherent and matted omentum. The course is subacute or chronic, with moderate fever or without any fever and general symptoms, or with extreme emaciation. A positive diagnosis is not always possible. In all cases of freely movable exudate the diagnosis lies between tuberculous peritonitis and ascites. Under anesthesia it is often possible by combined examination through the rectum and abdominal walls to feel the individual tubercles or to elicit a friction sound, so-called 'snow-ball crunching,' by rubbing the two layers of the peritoneum together. The presence of thickened and nodular tubes, as well as the discovery of tuberculosis in the intestines, lungs or skin, increases the probability of tuberculous peritonitis. Inoculation with tuberculin is an almost certain method of recognizing the tuberculous [illegible] of the process by the local and general reaction. The diagnosis

is easier if the presence of encapsulated ascites can be demonstrated by percussion and palpation, because tuberculosis is the most frequent cause of that condition. Heredity, emaciation and general weakness are in favor of tuberculosis.

3. **Gonorrheal peritonitis** results from the escape of gonococci from the abdominal extremity of the tube into the peritoneal cavity, and is characterized by acute stormy onset of local symptoms—with high fever, the absence of signs of intoxication, and rapid, invariably favorable course. As however these differences are not sufficiently precise for the diagnosis between gonorrheal and septic peritonitis, the origin of the peritonitis in gonorrhea of the genital organs or in tubal disease must, if possible, be demonstrated. The history may give support to the diagnosis if the patient admits a recent infection. Gonorrheal infection of the peritoneum more frequently leads to circumscribed pelvic peritonitis with adhesions.

Gonorrheal Peritonitis.

4. **Carcinomatous peritonitis** * develops in connection with carcinoma of the uterus and ovaries and leads to the production of ascites, which is usually freely movable, the eruption of small nodules, and flat adhesions in every portion of the peritoneum; later the intestines become adherent and larger nodes are formed in the peritoneum, especially in Douglas' space and on the contracted omentum. The exudate is easy to demonstrate, but the nodules can be felt only after they have attained a certain size. Douglas' space should always be carefully examined because multiple nodular formations and adhesion of the two layers of the peritoneum, and distinct 'snow-ball crunching' on combined examination through the rectum are most frequently found in that region. The omentum is accordingly the region where metastatic tumors are most frequently found. The differential diagnosis from tuberculous peritonitis is often very difficult. If, however, large tumors are found in the genitalia, especially with signs of malignant degeneration or distinct omental tumors or large nodes in Douglas' space, the condition is very probably carcinomatosis. But the clinical pictures in the two diseases may be so similar that they can barely be distinguished by careful inspection at the operation. Cachexia and crural edema are more frequently observed with carcinoma.

Pelvic Peritonitis.

Pelvic peritonitis is much more common in general, than in diffuse inflammation of the peritoneum. It usually begins in the genital organs and becomes localized on the peritoneum of the true pelvis and neighborhood, especially the abdominal walls. It is observed at every stage

* This form is included under infectious peritonitis, although the virus of carcinoma is still unknown.

from an acute beginning process to the remains of an old thickening of the membrane or adhesions. The acute onset of pelvic peritonitis is characterized only by intense signs of inflammation of the peritoneum; later a purulent or serous exudate is produced in the true pelvis, or the inflamed layers of the peritoneum become adherent. From a diagnostic standpoint we therefore distinguish three clinical pictures; recent pelvic peritonitis, peritonitis with exudate, and peritonitis with adhesions.

Pelvic Peritonitis.

I include under the term **recent pelvic peritonitis** the acute stage of exudative peritonitis with adhesions, relapses of pelvic peritonitis, and the recent circumscribed inflammations that grow around the individual genital organs. The common diagnostic feature of these forms of inflammation is therefore the recency of the process or the formation of inflammatory products. Acute perimetritis, perisalpingitis and perioöphoritis are concomitant conditions. The most important physical sign, on which the diagnosis of this early stage is based, is tenderness on pressure of the peritoneum elicited by external palpation of the abdominal walls with reflex tension of the abdominal muscles, or from within by palpation of those portions of the pelvis that are covered with peritoneum, or by displacing the uterus or adnexa. In the acute stage of exudative or adhesive peritonitis there may be local signs of irritation in the form of slight meteorism, strangury (tenesmus vesicæ) and, occasionally, vomiting and singultus; mild febrile movements are also quite common; spontaneous pain in the inflamed peritoneum may be so severe that the patient is unable to perform the slightest movements. In this stage the diagnosis can hardly be missed, although there are no characteristic physical signs and accurate palpation of the pelvic organs is impossible. The diagnosis is much more difficult in circumscribed processes, when all signs of irritation are absent and only peritoneal tenderness is elicited. The distinction between inflammatory and nervous pain is often very difficult. In such cases it must be determined whether the patient is one of those hyperesthetic women who start at the least touch of the abdominal walls as if they were suffering from severe peritonitis, and in making an internal examination it must be borne in mind that fear, excitement or awkward pressure with the finger may simulate peritonitic pain. If, however, local pain on pressure is constantly elicited in the same places on careful palpation or displacement of the genital organs, which are not in themselves painful, a diagnosis of peritonitis may be made even in the absence of an inflammatory product; whereas nervous peritoneal pain, whether due to hyperesthesia of the peritoneum or marked hyperesthesia of the skin such as occurs in lumbo-abdominal neuralgia, is changeable,

Recent Pelvic Peritonitis.

dependent upon external influences, and often out of all proportion to the degree of pressure employed.

The diagnosis of pelvic peritonitis is much more certain when the process has gone on to the deposition of an inflammatory product and produced physical signs.

The **exudate of pelvic peritonitis** (pelvic exudate), which owes its origin chiefly to infection with streptococci and staphylococci, is an effusion of serous, seropurulent or purulent fluid, and most frequently

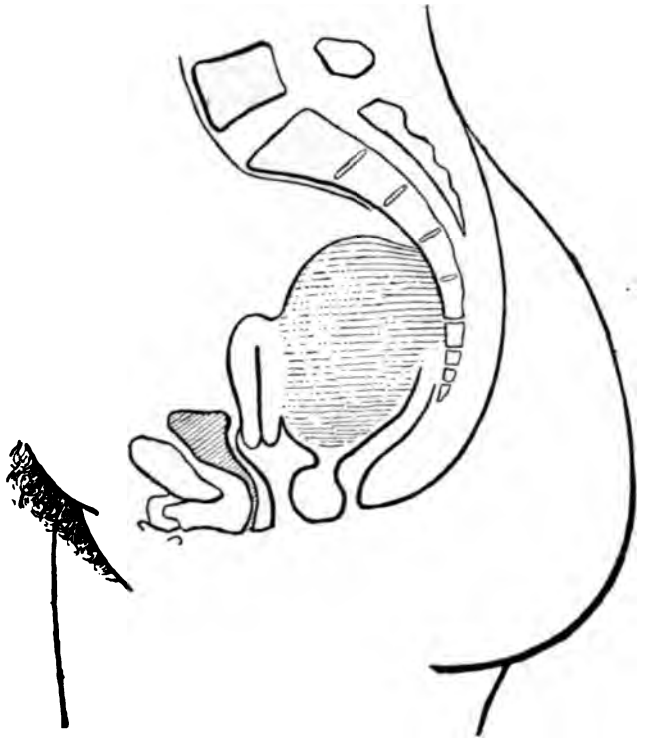

FIG. 287.—PELVIC EXUDATE. P.-F. ⅓. (Original.) Douglas' space contains an exudate as large as the fist and broadly adherent to the entire posterior wall of the uterus, which is in retroversion and anteposition; the exudate is also partly attached to the posterior pelvic wall.

becomes encapsulated in Douglas' space, uniformly filling the cavity if there are no adhesions. The uterus is displaced to the anterior pelvic wall so that the vaginal portion is felt immediately behind the symphysis and, if the exudate is extensive, below the upper border of the bone; while the uterine body and adnexa are in such intimate contact with the exudate that the boundaries of the latter are often difficult to make out. Behind the uterus the exudate is felt as a tumor which completely fills the upper portion of the true pelvis, occasionally projects far above the pelvic inlet, and is in contact with the anterior abdominal wall to one side or above the

The Exudate of Pelvic Peritonitis.

uterus. The upper half of the posterior vaginal wall is displaced far downward, often to within a short distance of the introitus; through the vault the lower border of the exudate is felt either round or with a blunt edge, depending on the tension to which it is subjected in Douglas' space. In front the exudate is partly in contact with the posterior wall of the uterus, usually as far as the fundus, and behind it is closely attached to the anterior sacral wall; while the lateral walls of the pelvis are reached only in the case of large tumors (Figs. 287 and 288). The roof of the exudate is formed by coils of intestine, hence the upper border is inaccessible to the palpating hand and often appears like an accumulation of ribbons filled with gurgling gases. In the recent stage the consistency of the exudate is always fluctuating; or it may be soft and yielding or tense and elastic, depending on the tension to which the exudate is subjected. In the neighborhood of the exudate irritative symptoms are observed, varying in intensity according as the exudate is serous or purulent. Thus, with an abscess in Douglas' space, the vaginal membrane is bluish, soft and boggy, with pulsating vessels; the rectal membrane swollen and edematous, secreting a glairy mucus which escapes from the anus. At the upper circumference of the exudate diffuse areas of thickening are found among the coils of intestines. In cases of serous exudate these signs of reaction are much more rare and may be wanting altogether.

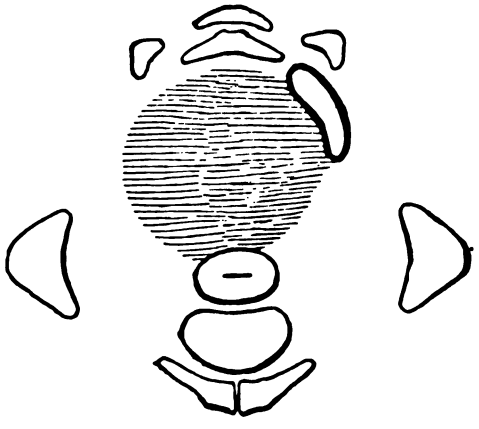

FIG. 288.—THE SAME IN CROSS SECTION. P.-F. ½. (Original.) The rectum is displaced far to the left by the exudate, but not entirely surrounded; the rectal wall bulges toward the lumen.

A deviation from the above typical findings will be observed when adhesions are present in Douglas' space and the exudate collects in the lateral pockets of the peritoneal cavity, in front and behind the broad ligament or in the vesico-uterine excavation. In such a case nothing can be felt through the vagina, and on bimanual palpation only indistinct resistance with fluctuation and without distinct outlines. Encapsulated collections of serous fluid are frequently found between adhesions, especially in the case of adnexal tumors—so-called adhesion cysts. If these cysts are accessible to the palpating finger through the os they are felt as a flaccid, cystic resistance without any distinct outline; if the fluid is under considerable pressure they feel like cystic tumors. Thus I once mistook a collection of adhesion cysts as large as a fist for a hydrosalpinx. After diffuse septic

Adhesion Cysts.

peritonitis encapsulated accumulations of pus or serous fluid sometimes remain in the upper abdominal cavity. Their presence can be demonstrated only if they have attained a certain size and are favorably situated for palpation, immediately underneath the abdominal walls. They are characterized by a very irregular shape, indistinct outlines and low tension.

The differential diagnosis between a serous and a purulent exudate can be made in a case of this kind by noting the reaction in the neighborhood. Softening and succulence of the vaginal mucous membrane, infiltration of the surrounding structures indicate pus; fever is an inconstant symptom and may be absent in old cases. On the other hand, a high leukocytosis (between 14,000 and 20,000 according to Pankow) is in favor of a purulent exudate.

Differential diagnosis. A retro-uterine exudate in the recent stage is always distinctly fluctuating and can therefore be mistaken only for a cystic tumor. The most important among adnexal tumors are those which develop low down in Douglas' space, especially pedunculated ovarian tumors. As hydrosalpinx is usually situated higher up and more to one side, it is more apt to resemble an asymmetrical exudate. A retro-uterine ovarian tumor with anteposition of the uterus may be mistaken for a retro-uterine exudate only if it is partly adherent to the surrounding structures and has lost its sharp contours; but even in cases of this kind accurate palpation of the tumor outline is the best means of arriving at a diagnosis. In an ovarian tumor it must be possible to feel a tumor-wall (Fig. 156), while in the case of exudate the limiting wall is supplied by the surrounding organs. The best way to determine this point is to make deep palpation from the side between the posterior uterine wall and the tumor, noting whether the two structures are distinct or intimately connected with one another by a broad surface of attachment; or by palpating the upper circumference, which in one case is a sharp, well-defined outline and in the other an indistinct contour formed by intestinal coils. Notable differences can sometimes be felt through the rectum. In benign tumors the rectum is only moderately displaced and possibly somewhat invaginated, while inflammatory processes—if they extend to the subperitoneal connective tissue—surround the rectum in the form of a loop. In the case of flaccid hydrosalpinx occupying part of the pelvis the diagnosis is more difficult. Although, like ovarian tumors, hydrosalpinx has a wall of its own, it is much more difficult to demonstrate than that of an ovarian tumor on account of its thinness and the much more numerous adhesions with the posterior uterine wall and the intestinal coils. If the woman can be kept under observation for some time, the pus will be slowly absorbed or spontaneously evacuated, and the diagnosis of exudate is

Differential Diagnosis.

septic peritonitis; black, liquid masses usually in small quantities are ejected without effort at short intervals. The most inconstant of all the symptoms is the presence of a clinically demonstrable exudate. In protracted cases, however, small movable masses of exudate can be recognized in the lumbar regions. Occasionally a large, freely movable collection, as in ascites, may be found.

Among the general symptoms the most valuable is the increase in the frequency of the pulse-rate. It is never absent and is usually the first sign of beginning inflammation. In the severe septic forms the pulse increases very rapidly and becomes small and irregular; in the milder forms the acceleration is much less. Fever is a much more inconstant symptom. It may be entirely absent or very slight in the gravest cases that rapidly terminate in death. In other cases the fever is moderate and rarely attains an excessive height. The course is not characteristic. The general appearance of the patient, especially the facial expression, may be so characteristic as in itself by mere inspection to suffice for diagnosis as well as prognosis. Restlessness, an anxious expression, wide open eyes and distorted features make up a picture which is absolutely typical of peritonitis.

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Tuberculous Peritonitis.

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Recent Pelvic Peritonitis.

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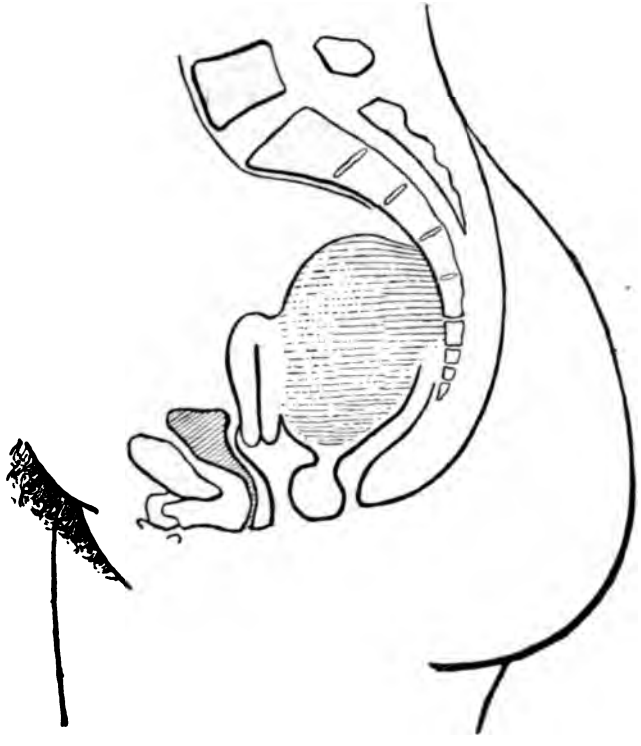

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The Exudate of Pelvic Peritonitis.

uterus. The upper half of the posterior vaginal wall is displaced far downward, often to within a short distance of the introitus; through the vault the lower border of the exudate is felt either round or with a blunt edge, depending on the tension to which it is subjected in Douglas' space. In front the exudate is partly in contact with the posterior wall of the uterus, usually as far as the fundus, and behind it is closely attached to the anterior sacral wall; while the lateral walls of the pelvis are reached only in the case of large tumors (Figs. 287 and 288). The roof of the exudate is formed by coils of intestine, hence the upper border is inaccessible to the palpating hand and often appears like an accumulation of ribbons filled with gurgling gases. In the recent stage the consistency of the exudate is always fluctuating; or it may be soft and yielding or tense and elastic, depending on the tension to which the exudate is subjected. In the neighborhood of the exudate irritative symptoms are observed, varying in intensity according as the exudate is serous or purulent. Thus, with an abscess in Douglas' space, the vaginal membrane is bluish, soft and boggy, with pulsating vessels; the rectal membrane swollen and edematous, secreting a glairy mucus which escapes from the anus. At the upper circumference of the exudate diffuse areas of thickening are found among the coils of intestines. In cases of serous exudate these signs of reaction are much more rare and may be wanting altogether.

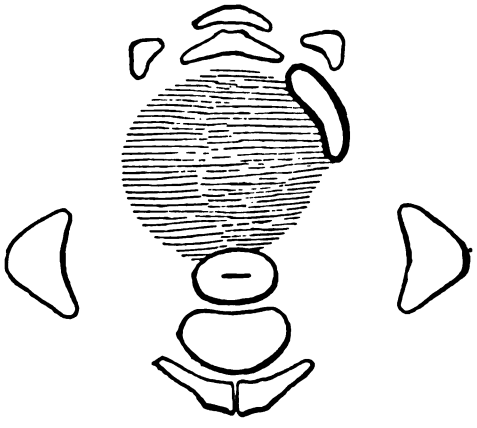


FIG. 288.—THE SAME IN CROSS SECTION. P.-F. ⅓. (Original.) The rectum is displaced far to the left by the exudate, but not entirely surrounded; the rectal wall bulges toward the lumen.

A deviation from the above typical findings will be observed when adhesions are present in Douglas' space and the exudate collects in the lateral pockets of the peritoneal cavity, in front and behind the broad ligament or in the vesico-uterine excavation. In such a case nothing can be felt through the vagina, and on bimanual palpation only indistinct resistance with fluctuation and without distinct outlines. Encapsulated collections of serous fluid are frequently found between adhesions, especially in the case of adnexal tumors—so-called adhesion cysts. If these cysts are accessible to the palpating finger through the os they are felt as a flaccid, cystic resistance without any distinct outline; if the fluid is under considerable pressure they feel like cystic tumors. Thus I once mistook a collection of adhesion cysts as large as a fist for a hydrosalpinx. After diffuse septic

Adhesion Cysts.

peritonitis encapsulated accumulations of pus or serous fluid sometimes remain in the upper abdominal cavity. Their presence can be demonstrated only if they have attained a certain size and are favorably situated for palpation, immediately underneath the abdominal walls. They are characterized by a very irregular shape, indistinct outlines and low tension.

The differential diagnosis between a serous and a purulent exudate can be made in a case of this kind by noting the reaction in the neighborhood. Softening and succulence of the vaginal mucous membrane, infiltration of the surrounding structures indicate pus; fever is an inconstant symptom and may be absent in old cases. On the other hand, a high leukocytosis (between 14,000 and 20,000 according to Pankow) is in favor of a purulent exudate.

Differential diagnosis. A retro-uterine exudate in the recent stage is always distinctly fluctuating and can therefore be mistaken only for a cystic tumor. The most important among adnexal tumors are those which develop low down in Douglas' space, especially pedunculated ovarian tumors. As hydrosalpinx is usually situated higher up and more to one side, it is more apt to resemble an asymmetrical exudate. A retro-uterine ovarian tumor with anteposition of the uterus may be mistaken for a retro-uterine exudate only if it is partly adherent to the surrounding structures and has lost its sharp contours; but even in cases of this kind accurate palpation of the tumor outline is the best means of arriving at a diagnosis. In an ovarian tumor it must be possible to feel a tumor-wall (Fig. 156), while in the case of exudate the limiting wall is supplied by the surrounding organs. The best way to determine this point is to make deep palpation from the side between the posterior uterine wall and the tumor, noting whether the two structures are distinct or intimately connected with one another by a broad surface of attachment; or by palpating the upper circumference, which in one case is a sharp, well-defined outline and in the other an indistinct contour formed by intestinal coils. Notable differences can sometimes be felt through the rectum. In benign tumors the rectum is only moderately displaced and possibly somewhat invaginated, while inflammatory processes—if they extend to the subperitoneal connective tissue—surround the rectum in the form of a loop. In the case of flaccid hydrosalpinx occupying part of the pelvis the diagnosis is more difficult. Although, like ovarian tumors, hydrosalpinx has a wall of its own, it is much more difficult to demonstrate than that of an ovarian tumor on account of its thinness and the much more numerous adhesions with the posterior uterine wall and the intestinal coils. If the woman can be kept under observation for some time, the pus will be slowly absorbed or spontaneously evacuated, and the diagnosis of exudate is

Differential Diagnosis.

established; while a hydrosalpinx usually remains stationary, and ovarian tumors slowly increase in size. General disturbances and fever are in favor of inflammatory processes.

The greatest difficulties are encountered in the diagnosis between exudate and a typical retro-uterine hematocele. The shape and situation of the tumor and its broad attachment to the uterus and pelvis are exactly the same as in the case of exudate, because the fluid blood also collects in Douglas' space and by encapsulation and organization of the periphery also becomes intimately adherent to the other organs. The only difference observed in hydrosalpinx is in the consistency. The blood coagulates; the consistency becomes irregular, cystic portions alternating with soft masses. If the blood remains fluid, the consistency may be exactly the same as that of exudate. As the presence of blood causes but slight signs of irritation in the neighborhood, the signs resemble those of serous exudate. If the hematocele breaks down, however, the inflammatory symptoms in the neighborhood increase and the picture of pelvic abscess is produced. In many cases the history affords positive data for the differential diagnosis. If it is found that the condition was preceded by a short period of amenorrhea; if the onset was severe, with frequently repeated abdominal cramp, and pain without fever, the probability is on the side of hematocele (*ex graviditate tubaria*); while acute onset with high fever and signs of peritonitic irritation point to exudate. Serous exudates usually develop without fever or pain. Anemia and a mild degree of jaundice, as well as uterine hemorrhages, are in favor of hematocele. The leukocyte count appears to be a valuable means of distinguishing between pelvic abscess and a non-infected hematocele. In the latter the number of leukocytes is normal, unless the patient is extremely anemic; but once the hematocele breaks down, the leukocytosis becomes very high. In cases of serous exudate the difference is less marked. The surest means of arriving at the correct diagnosis between hematocele and serous or purulent exudate is exploratory puncture. As the posterior vault of the vagina only is punctured and no organ is injured, aseptic perforation is not followed by any bad results. After careful disinfection of the vagina an aspiration needle with a thin canula is introduced into the deepest portion of the retro-uterine tumor behind the portio vaginalis, under guidance of the finger. But even in these cases exploratory puncture should be employed only as a last resort.

The diagnostic value of exploratory puncture through the posterior vaginal vault forms the subject of an essay by Franz, who reports that among 81 cases from his clinic in Halle the diagnosis was confirmed in 56; a doubtful diagnosis was rendered positive in 5; an erroneous diagnosis corrected in 10; in 6 exploratory puncture was misleading, and in 4 without result. It appears therefore that exploratory puncture is not superior to other methods of examination, since the 10 successful cases are balanced by 10 failures.

That the method even in the simple cases and when performed in a hospital is not without danger is shown by the fact that it was followed by severe infection in one case, by mild infection in 5 others, while in the 6th death probably was remotely or partly due to the exploratory puncture. These results justify my advice that the use of exploratory puncture be restricted as much as possible.

A retro-uterine exudate is less likely to be mistaken for retroflexion of a gravid uterus than for hematocele, because the history is not so misleading. The diagnosis is based on the same principles as have been explained in connection with hematocele (see p. 167).

Peritonitic adhesions represent either the remains of old inspissated, ruptured, or evacuated exudates, or the product of pelvic peritonitis with adhesions. In the former case they represent thick, brawny cicatrizations, with partial obliteration or localized contraction of individual portions of the peritoneum. In the latter case they are membranous bands of variable thickness, which envelop the organs or connect them with one another or with the pelvic wall.

Peritoneal Adhesions.

The diagnosis of these inflammatory products is based on the direct palpation of brawny, diffuse thickening in Douglas' space, producing complete or partial obliteration of the space with retroposition of the uterus. The thickened areas can be felt by pushing the posterior vaginal vault upward, or through the rectum. When the uterus is drawn forward it brings the anterior rectal wall with it. Localized contractions of the peritoneum are recognized by numerous thickenings and want of elasticity in the membrane. Genuine peritonitic adhesions are felt as membranes or bands connecting those portions of the genitalia which are covered with peritoneum, especially in Douglas' space and in the neighborhood of the adnexa. By pushing the vaginal vault forcibly upward they may be felt as thin, delicate cords that are easily torn by the pressure of the finger and are usually painful. Another sign of peritonitic adhesions is the fixation of otherwise movable organs, especially the uterus, tubes, ovaries and intestines. If the mobility of the uterus in any given direction is abolished, or if it is found impossible to elevate a retroflexed uterus, the existence of peritonitic adhesions may be inferred, provided the immobility is observed constantly in those parts which are covered with peritoneum. If a prolapsed ovary cannot be lifted out of Douglas' space, or a normally placed ovary has lost some of its normal mobility along the pelvic wall, we have to deal with the remains of a perioöphoritic inflammation. If immovable coils of intestines are constantly found at certain points on a tumor, or permanently occupy Douglas' space, they are probably fixed by peritonitic adhesions. The presence of the latter may also be surmised when there is local pain on pressure in places covered by peritoneum. If, for example, in the case of large ovarian tumors certain areas are constantly found to be painful, it is a sign of local peritonitis, and at laparotomy circumscribed peritoneal adhesions are usually found in these regions.

Diagnosis of Parametritis.

Definition.

Parametritis is inflammation of the pelvic connective tissue situated between the peritoneum and the levator ani muscle and occupying the intervals between the individual pelvic organs which it completely surrounds (p. 90). Parametritis also includes paracystitis and paraproctitis, or inflammation of those portions of the pelvic connective tissue which surround the bladder and rectum respectively. Parametritis in the great majority of cases begins in the pelvic connective tissue that surrounds the genitalia and from that area may spread to more distant layers of connective tissue that are continuous with the parametrium, such as the preperitoneal cavity of Retzius and the connective tissue of the iliac bone, which is continuous with the retroperitoneal tissue. Conversely, connective tissue inflammation, originating in distant organs, as paratyphlitis or paranephritis, for example, may spread downward to the pelvic connective tissue and produce conditions similar to primary parametritis.

Parametritis occurs in two distinct forms: exudative and contracting parametritis (parametritis retrahens).

I. Parametritic Exudate.

A parametritic exudate is the product of a tissue reaction which follows invasion by microörganisms.

The organisms concerned are almost exclusively streptococci and staphylococci, rarely gonococci and bacterium coli; in isolated cases tuberculosis and actinomycosis have been observed. The differences produced in the clinical picture of the exudate by the different kinds of organisms will be discussed later.

The tissue reaction results in the deposition of a gelatinous fluid in the meshes of the connective tissue and, in the recent stage, represents a soft elastic swelling of the affected region, with blurring of the outline. After the edema in the surrounding tissue has subsided by absorption, and the inflammatory fluid has coagulated, the exudate appears in its characteristic form as a hard tumor. As such it persists for a long time, and the inspissated contents become more and more hard and firm. The exudate may disappear completely by absorption, leaving normal, soft connective tissue in its place; but there remains a brawny thickening, which leads to the contraction of the tissues and uterine displacement. If the exudate continues to spread, the same changes take place in successive portions of the connective tissue, while absorption goes on in other places. If the exudate breaks

down and suppurates; small abscesses are formed in various places, which gradually coalesce and produce large collections of pus that usually follow a definite path to the outer surface of the body.

Diagnosis.

The diagnosis of parametritic exudate is based on the finding of a tumor in the pelvic connective tissue presenting certain important characteristics, determined by external and internal examination.

Position. The tumor must occupy a region which contains parametrial connective tissue or one of its processes. The most frequent situation is the posterolateral portion of the horizontal layer of the connective tissue, the tumor forming to one side and behind the uterus; secondarily a portion of the exudate usually spreads in the retro-uterine tissue to the other side of the pelvis and forms a loop around the rectum (Fig. 289). More rarely the exudate is entirely confined to the retro-uterine tissue. In such a case a retro-uterine tumor situated almost exactly in the median line is produced, the lateral portions of which are flattened and broken up into fibres; while below, the tumor extends into the recto-vaginal septum and usually ends in a sharp border opposite the middle of the posterior vaginal wall (Fig. 290). Puerperal exudates are often situated between the layers of the broad ligament, forming large tumors alongside of the uterus and above the pelvic inlet. They frequently extend into the true parametrium and therefore cannot be palpated through the vagina; at the sides they approach the pelvic wall in the infundibulopelvic ligament (Fig. 291). If the exudate is situated in the connective tissue on the iliac bone, a flat tumor is produced with broad attachment to the bone and connected with the uterus by a broad ligament as by a cord, or even entirely free, so that it gives the impression of being an independent tumor. If the extension takes place from this point upward, the connective tissue of the lateral and posterior abdominal wall becomes involved; while in front the exudate may extend above Poupart's ligament and reach the anterior abdominal wall. From the parametrium the exudate, after elevating the anterior layer of the broad ligament, enters the loose connective tissue which sur-

FIG. 289.—PARAMETRITIC EXUDATE IN THE LEFT POSTERIOR QUADRANT. P.-F. ⅓. (Original.) The exudate spreads to the other side in the retrocervical tissue, surrounding and constricting the rectum.

Situation of the Exudate.

rounds the bladder and the preperitoneal cavity of Retzius (Fig. 292), and from that point extends upward in the subperitoneal adipose tissue of the anterior abdominal wall. These exudates in the abdominal wall do not extend beyond the region of the navel because at this point the loose connective tissue between the parametrium and the fascia disappears. Nor do they overstep the median line, so that in the main they represent flat masses or thickenings limited to one half of the anterior abdominal wall. The anterior parametrium, or that portion

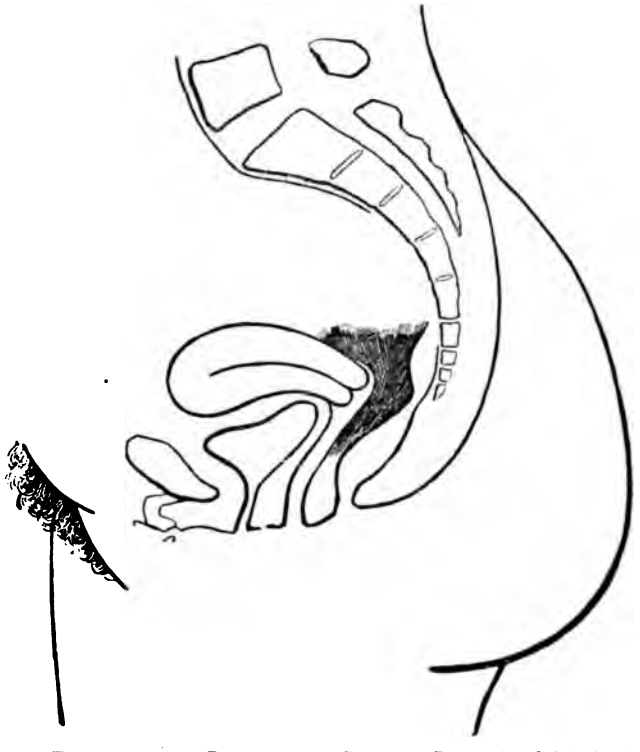


FIG. 290.—PARAMETRITIC EXUDATE IN THE RECTOVAGINAL SEPTUM. P.-F. ½. (Original.) The exudate of Fig. 289 shown in median section. It extends to within 4 cm. of the introitus; marked stenosis of the rectum.

of connective tissue which is situated between the cervix and body, is very rarely the seat of exudation. The exudate, when it occurs, forms a cord-like tumor extending upward to about the middle of the uterus and disappearing on each side of the horizontal layers of the pelvic connective tissue (Fig. 293). When suppuration takes place in the parametritic exudate, the pus follows certain definite paths, along which the solid exudate also extends. For example, the pus not infrequently escapes from the pelvic cavity through the sciatic notch and makes its appearance under the free border of the gluteus maximus on the buttocks; occasionally the pus may burrow in the paravaginal and paraproctal tissue and make its appearance on the perineum.

The **shape** of the exudate is exceedingly variable, depending on the shape of the layer of connective tissue in which it develops. Wherever the exudate is limited by peritoneum it is completely spherical; while in places where it merges with healthy connective tissue it is irregular and diffuse, and the shape of the inflammatory mass is flat and radiating. When the exudate is in contact with organs—the pelvis, uterus or rectum—the latter form a sharp boundary and are often enveloped by the exudate. Exudates in the horizontal layer of connective tissue are flat and diverge widely, especially in the lower portion. They surround the rectum, descend along the side of the vaginal vault, and spread out on the pelvic wall. The upper surface of intraligamentary exudates, so far as it is covered by the separated layers of the broad ligament, is perfectly round; while the lower portions are broadened out and are gradually lost in the horizontal connective tissue layer. Exudates on the lateral and posterior abdominal wall are perfectly flat and spread out, while on the anterior abdominal wall the exudate becomes thinner and thinner toward the body and ends in a sharp edge; below, it gradually becomes broader and more massive and is lost in the horizontal connective tissue layer. Large exudates in the folds of Douglas are also spherical where they are covered with peritoneum, while below they are broad.

Shape of the Exudate.

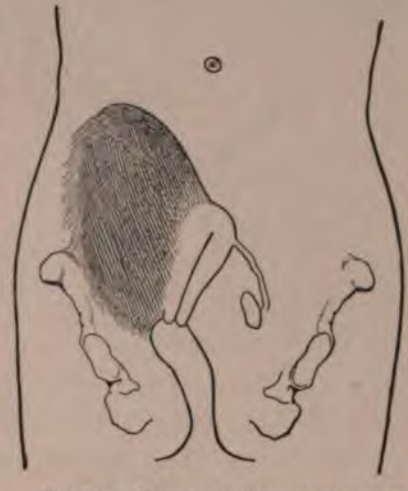


FIG. 291.—PUERPERAL INTRALIGAMENTARY EXUDATE. P.-F. ⅙. (Original.) The exudate has prevented the normal puerperal descent of the uterus; the fundus is midway between umbilicus and symphysis, and the vaginal portion at the level of the pelvic inlet. The right broad ligament contains an exudate the size of a fetal head, leaving the horizontal parametrium free; the exudate is broadly attached to the iliac bone.

The **connection** of the exudate with neighboring structures is one of its most important properties because it is the chief point of distinction between exudate and tumor. When the inflammatory process reaches the pelvis or one of the organs, it spreads around and along the structure into the meshes of connective tissue and, as coagulation takes place, a broad, intimate union is produced. Exudates in the lateral portion of the parametrium have a broad attachment to the lateral pelvic wall (Fig. 292). The union with the uterus is also extremely intimate in those places in which parametrial connective tissue comes in relation with the organ. Exudates in the horizontal connective tissue have a broad attachment with the lateral and posterior surfaces of the cervix, fre-

Connection of the Exudate with Surrounding Structures.

quently surround the posterior surface, rarely the anterior, and occasionally encircle the entire structure. Intraligamentary exudates attach themselves to the lateral aspect of the uterus, which they also occasionally surround, and extend to the anterior and posterior surfaces (Figs. 294 and 295) after separation of the loosely attached peritoneum. Above, the exudate is limited by the boundary line between the loose and the firm peritoneal attachment and therefore never reaches the fundus. If the exudate is in relation with the vagina, which is usually the case posteriorly, the attachment is so intimate that the vaginal wall becomes immovable; when the condition is merely a flat infiltration instead of a large tumor, one gets the impression that the posterior vaginal wall itself is very firm and unyielding. The connection with the rectum is the most characteristic of all. On the diseased side the exudate is intimately attached to the structure and produces a rigid semicircle which merges on each side with the flat exudate; if the exudate also involves the retro-uterine tissue and the other quadrant, the ring around the rectum becomes complete and in contracting

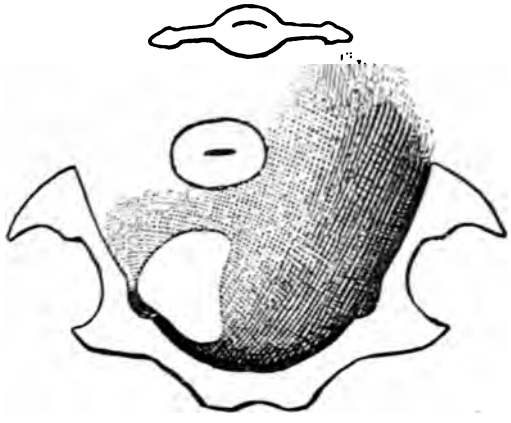


FIG. 292.—PARAMETRITIC EXUDATE IN THE LEFT ANTERIOR QUADRANT AND ANTERIOR PARAMETRIUM. P.-F. ⅓. (Original.) The exudate has a broad attachment to the anterior and left wall of the pelvis, displacing the body to the right, and extending between the body and the anterior cervical wall to the other side.

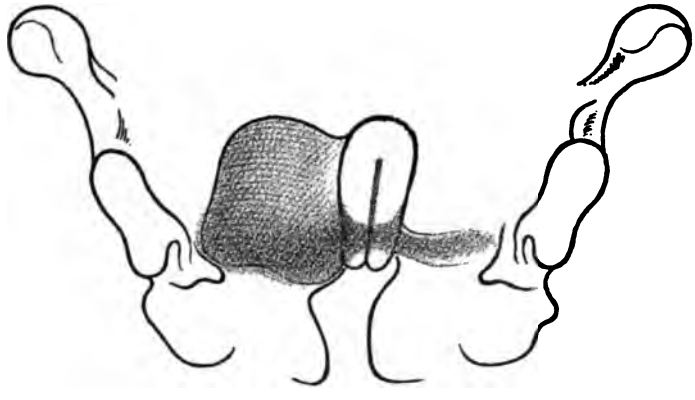


FIG. 293.—PARAMETRITIC EXUDATE IN THE RIGHT BROAD LIGAMENT AND ANTERIOR PARAMETRIUM. P.-F. ⅓. (Original.) The exudate fills the entire right ligament and extends to the pelvic wall. It forms a cord as thick as the thumb, which passes in front of the cervix, between it and the bladder, to the other side of the pelvis, where it gradually breaks up and reaches the pelvic wall. The connection of the exudate with the uterus in front extends as far as the line which marks the loose attachment of the peritoneum with the organ.

produces stenosis of the lumen, so that the finger can only be introduced with difficulty. In order to follow its connection with the rectum, the finger must be inserted above the fold of Kohlrausch. The mucous

FIG. 294.—PARAMETRITIC EXUDATE OCCUPYING THE LEFT BROAD LIGAMENT AND ILIAC BONE. P.-F. ⅓. The horizontal layer of connective tissue is not involved and the exudate is broadly adherent to the iliac bone; the median portion of the exudate is readily movable with the uterus.

membrane is immovable on the exudate. For the changes produced by the attachment of the exudate to the bladder see page 496.

The **mobility** of parametritic exudates depends on their connection with the pelvis. The more extensive the attachment, the more immovable the tumor; while, on the other hand, the median portion of the exudate may retain a high degree of mobility (Fig. 294). Intraligamentary exudates which are no longer attached to the pelvis may exhibit a very great degree of mobility with the uterus.

FIG. 295.—THE SAME IN CROSS SECTION. P.-F. ⅓. Broad attachment to the left aspect of the uterus. The exudate surrounds and causes separation of the posterior cleft of the ligament.

The **consistency** is not characteristic and may vary from succulence to bony hardness. Recent exudates are soft, elastic, and somewhat yielding to the touch, but within a few days the succulence subsides and the exudate grows hard and unyielding. The hardness rapidly increases, the exudate gradually becoming more and more firm and cicatricial.

Pain has no diagnostic value. On the contrary, large parametrial exudates are practically painless, except when parametritic and tubal tumors are associated.

Certain data obtained from the history are important. Parametritis always results from infection: hence a cause for infection should be sought in parturition, abortion, operations on the genitalia, intraligamentary uterine manipulations, or some injury during menstruation. In doubtful cases the diagnosis may find support in a positive statement of this kind, especially if a time relation can be established between the disease and the exposure to infection. The mode of onset with chill, followed by a febrile course, may establish the inflammatory nature of the condition; but it must be remembered that a negative history in this respect does not exclude infection, because the fever may be so short that the woman pays no attention to it.

History.

Keeping the patient under observation may also help to make the diagnosis. Fever indicates an inflammatory infection. In parametritis it is usually distinctly remittent and, if protracted, points to further extension of the process. Rapid extension during the recent stage and gradual diminution in the size of the tumor during the stage of absorption indicate an exudate. The general condition and the symptoms furnish no information of any value.

Observation.

Differential Diagnosis.

Owing to the frequency of parametritic exudates and the great variety of physical signs to which they give rise the differential diagnosis is extremely important. Exudates may be mistaken for any kind of hard tumor in the neighborhood of the uterus.

Inspissated exudates, especially the spherical, intraligamentary masses with broad attachment to the uterus, may closely resemble subserous myomata. The distinction is made by the outline, which in the case of myoma is everywhere round except at the pedicle; while a parametritic exudate is only round above, where it is covered by two layers of the broad ligament (especially when there is no complicating perimetritis with intestinal adhesions), and below and to each side flattens out with the lateral spreading of the connective tissue and is firmly attached to the pelvic wall. Again the connection between the uterus and a myoma is always more or less pedunculated, although the pedicle may appear broad; whereas exudates are much more intimately attached to the uterus, surround the organ after causing separation of the loosely attached peritoneum, and come in close contact with the anterior or posterior wall. Often the diagnosis is cleared up by discovering continuations of the exudate in the rectovaginal septum and other portions of the pelvic connective tissue. In doubtful cases a rectal examination should be made. In the case of myoma the lower portion of the tumor is round and distinctly

Subserous Myomata.

separated from the pelvic wall, while in exudate the attachment to the pelvic wall is more easily recognized through the rectum. When a myoma and an exudate are present at the same time, the diagnosis is very difficult. In the case of intraligamentary exudate the difficulty is that the inflammatory mass does not involve the horizontal connective tissue and the characteristic broadening of the lower portion is not present; the diagnosis in such a case may often be based merely on the presence of a few adhesions. Mobility is not necessarily a sign of myoma, as intraligamentary exudates that do not extend as far as the pelvic wall may be movable with the uterus; on the other hand, exudates limited to the horizontal connective tissue differ from myomata by the fact that they are immovable.

Intraligamentary peritoneal exudates are much less likely to be mistaken for myomata because the contents are fluid and remain fluid for some time; but ultimately they become inspissated, the consistency more firm, and the outline at the same time irregular, thereby greatly assisting the diagnosis. In the differential diagnosis between myoma and intraligamentary peritoneal exudate roundness of contour is always in favor of myoma, particularly at the upper portion of the tumor, where the adherent coils of intestine produce a very irregular boundary in the case of exudate; while below, where the exudate is covered by the peritoneum of Douglas' space, the outline may also be round.

The symptoms are practically of no value in the differential diagnosis between myoma and exudate. Even pain may be completely absent in the case of an old exudate. On the other hand, the statement that the disease began acutely with fever is of considerable diagnostic value and points to exudate. Keeping the patient under observation may assist greatly in the differential diagnosis between these two conditions. A myoma retains its size or increases very little; at all events it never becomes smaller or at most very slowly under certain favorable conditions, while an exudate may disappear altogether in a short time, especially if measures calculated to promote absorption are employed, or it may diminish considerably in size, or the shape may be altered in course of time and the exudate is easily recognized by the covering and the connection with the neighboring organs. Hence in all doubtful cases a second examination at the end of about two months will help to establish the diagnosis.

The leukocyte count does not always furnish the desired information. Although myoma by itself never produces leukocytosis, and the sign is never absent in the recent and subacute stages of pelvic exudate, yet an old exudate, which is more likely to be mistaken for a myoma, has no influence on the number of leukocytes.

Fritsch reports a case that illustrates the importance of this differential diagnosis.—"Many years ago," he says, "I did an ovarectomy on a patient who had come a long distance on account of a myoma as large as a fetal head with severe hemorrhage. The patient had no fever and left the hospital cured. Ten weeks later severe fever began and I discovered a parametritis at the usual site above Poupart's ligament; the pus was discharged and the tumor disappeared. I had mistaken an old exudate for a myoma and the ovarectomy was entirely useless."

The differential diagnosis between parametritic exudate and pyosalpinx is often exceedingly difficult. The two conditions have often been confounded on account of the similarity in the history, symptoms and physical signs. Even at the present time there is no doubt that most cases of pyosalpinx are mistaken for exudates by inexperienced examiners; indeed it may tax all our diagnostic resources to decide between an exudate and a tubal tumor, or to determine in a case of exudate whether the tube is also diseased. The consistency is obviously no criterion, as pyosalpinx, unless it contains a very large quantity of pus, does not give fluctuation and feels quite as hard as an exudate; on the other hand, the position of the tumor with reference to the uterus is important. Exudates in the main occupy a deeper position alongside of the cervix and sometimes crowd the vaginal vault downward. Even when they are situated in the broad ligament, alongside of the body, they usually involve the lower portion of the body and spread in the horizontal connective tissue. When, on the other hand, the tumor is situated high up alongside of the fundus and at the posterior wall of the body, it is probably a case of tubal disease. Exudates are usually flat and diffuse, while tubal tumors are round, particularly above, and even when associated with exudates usually present a roundness somewhere. On examining from below or through the rectum it is difficult to distinguish between the two conditions, for the reason that it is precisely below the base of the pyosalpinx that exudates are most likely to accumulate. Pus tubes are usually more movable with the uterus than exudates. If a tumor of the above-described properties is found on both sides of the fundus, bilateral tubal disease is very probable.

Hematomata in the pelvic connective tissue give rise to physical signs very similar to those of an exudate, and a positive distinction is not always possible. In the broad ligament the effusion of blood in the pelvic connective tissue, which usually results from a rupture of a large vein or a gravid tube, burrows and lacerates the connective tissue and follows up the processes in a manner very similar to that of an exudate. The most common seat of hematoma is alongside of the uterus in the broad ligament. From here it extends to the pelvis, often surrounding the posterior surface of the uterus (Fig. 296), and enters the parametrium on the opposite side. Large hematomata

Hematomata in the Broad Ligament.

spread out on the iliac bone or produce tumors above the pelvic inlet. At first the consistency is soft and elastic, but coagulation soon takes place and the tumor becomes harder, although never uniformly firm like that of an exudate. Fluid and solid portions alternate, and occasionally the crunching of blood clots can be detected. The connections between a hematoma and the pelvis and uterus are not usually so extensive and intimate as in the case of exudate; hence the chief distinction between hematoma and exudate are the consistency, which is always more uniformly firm in exudate, the shape, which in hematoma is generally speaking round, rarely with long processes extending into the adjoining tissue, while exudates are usually flatter and more diffuse and occasionally have broad connections with adjoining organs. In old hemato-

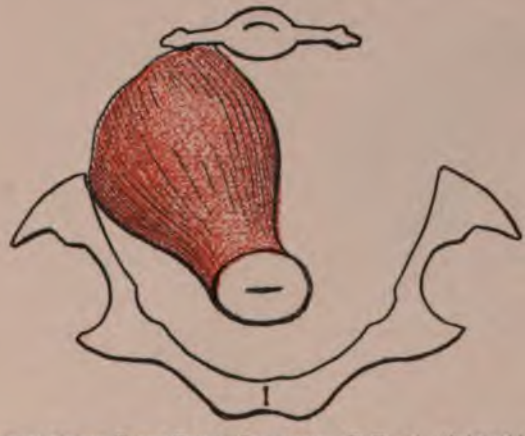


FIG. 296.—HEMATOMA IN THE RIGHT BROAD LIGAMENT. P.-F. ⅓. (Original.) The tumor is broadly attached to the right lateral aspect of the uterus and has produced bulging and partial separation of the posterior layer. The consistency is alternately hard and soft; the horizontal connective tissue is not involved. —Four weeks previously the woman had a fall, followed by irregular hemorrhages. The diagnosis was confirmed by the aspiration of blood.

mata the surface is often round; in exudates these changes occur later and are always less distinct. In some cases the physical signs are not sufficiently definite for a differential diagnosis, particularly as hematoma is usually accompanied by inflammatory thickening of the connective tissue. In these cases the clinical history must be consulted. Exudates usually begin acutely with fever and possibly with chills; while hematoma as a rule owes its origin to traumatism, particularly during menstruation; fever is absent; and, on the other hand, long continued hemorrhages frequently occur, the patient complaining of a sense of tension. Anemia, occasionally associated with a slight degree of jaundice, is usually present if the hematoma is large.

The leukocyte count may decide the diagnosis. Leukocytosis is always absent in cases of hematomata unless the patient is very anemic; while it is present in exudate, although somewhat variable.

Perityphlitic and paratyphlitic exudates of long standing may be confounded with parametritic exudates on the iliac bone, especially if they extend deep down into the broad ligament and approach the uterus. Since, on the other hand, the connection between the uterus and a parametritic exudate that has spread upward to the iliac bone may be absorbed and disappear, the physical signs in the two conditions may be quite similar. As a rule, however, the main portion of the mass is found on the iliac bone in cases of paratyphlitis, while the median portion of the broad ligament is entirely free and soft (Fig. 297). Perityphlitic exudates are also characterized by their softness and the indefinite character of their upper contour toward the abdominal cavity, where they are covered with the

Perityphlitic and Paratyphlitic Exudates.

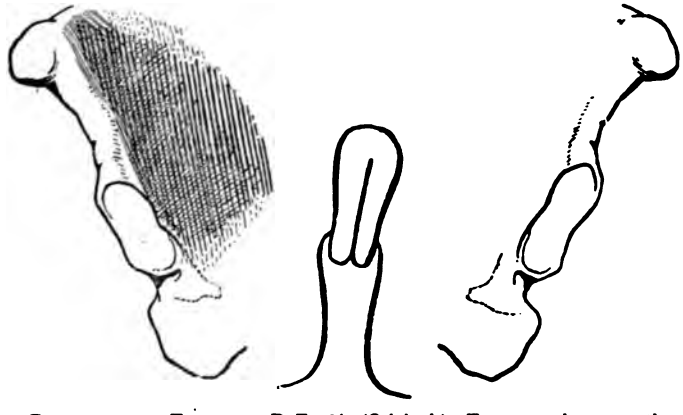


FIG. 297.—PARATYPHLITIC EXUDATE. P.-F. ⅓. (Original.) Tumor as large as the fist, firmly adherent to the iliac bone and extending somewhat into the pelvis. The tumor is separated by a considerable interval from the uterus. At the periphery the consistency is very hard; but above, where the tumor is covered with intestine, it is soft.

cecum, and by their dull tympanitic note. Paratyphlitic exudates envelop the cecum, while parametritic exudates are more apt to lie flat on the iliac bone. In the cases of perityphlitis there is a history of intestinal symptoms, meteorism, colic, long continued constipation, especially at the beginning, and numerous relapses of acute inflammation with similar symptoms. If the formation of the exudate can be observed; it will be found that the cecum is the starting point of the localized tenderness on the iliac bone. Here the exudate first begins to form, while the immediate surroundings of the genitalia are quite free.

Carcinomatous infiltrations of the pelvic connective tissue such as follow carcinoma of the uterus, vagina, ovaries, bladder or rectum produce practically the same physical signs as exudates in the same regions. In both conditions the connective tissue contains hard masses, producing circumscribed or extensive tumors in the parametrium itself or in the connective tissue around the bladder and

Carcinomatous Infiltration.

rectum. Whenever an infiltration is directly continuous with the carcinomatous focus that can be felt through the vagina, or develops underneath an ovarian tumor with the suspicion of malignancy, the carcinomatous nature of the infiltration itself will at once suggest itself. Not so, however, in the case of carcinoma of the bladder and rectum, because these organs are not examined routinely when there are no symptoms. As a rectal cancer spreads into the tissue between the rectum and posterior wall of the cervix, it produces a tumor at the exact site of a retrocervical exudate, and I have not infrequently seen a rectal cancer mistaken for an exudate until the case was cleared up by finding a primary focus or by a rectal examination.

CASE 29.—Mrs. M. came here from Russia because one physician told her that she had a tumor underneath the uterus and another diagnosed a retroflexed uterus which he desired to straighten. Physical signs: through the posterior vaginal wall there is felt a hard tumor, somewhat broader than the uterine body, and broadly attached to the cervix, in close relation with the vaginal wall, practically immovable, and attached to the pelvic wall. Retroflexion is excluded at once because the small senile body is felt in front of the tumor; but rectal examination reveals an extensive, chiefly periproctal carcinoma, which has spread in the retro-uterine parametrium as far as the cervix. The starting point is a tumor in the posterior parametrium, which represents a recurrence after extirpation of bilateral carcinomatous ovarian tumors.

Similar conditions are found in the parametrial tissue, where the carcinoma breaks through the bladder wall.

The diagnosis may be difficult in cases of recurrence, when the primary focus is absent and the history of a previous operation suggests an old inflammatory focus. If a correct diagnosis cannot be reached by demonstrating a connection between the tumor and a primary focus, one must judge by the properties of the tumor. Carcinomatous tumors have a hard, cartilaginous consistency; while exudates are fibrous and firm. In carcinoma there is a tendency to concentric enlargement, the surface is uneven, the outline more round, and there are no flat processes. Spontaneous neuralgic pain, cachexia and edema of the legs occur only in carcinoma.

The differential diagnosis between perimetritic and parametritic exudate is often exceedingly difficult and may be impossible even to the keenest diagnosticians because the two conditions are frequently combined. There are, however, a few points of distinction which make the differential diagnosis possible in most cases. Laterally situated tumors usually belong to the connective tissue, while median tumors situated behind the uterus belong to Douglas' space. Hence retro-uterine exudates, which may originate either in Douglas' space or in the retro-uterine cervical parametrium, are the only conditions that are likely to give rise to mistakes. The displacement of the uterus indicates the position of the exudate.

Peritonitic Exudate.

Marked lateropositions indicate peritonitic exudates on each side of the uterus; anteposition suggests tumors in Douglas' space or in the retrocervical tissue. The parametritic exudate develops underneath Douglas' space and is therefore on the whole somewhat lower down and nearer the posterior vaginal wall; as a result the vaginal wall is firmly attached to the tumor and immovable, whereas simple exudates in Douglas' space, provided the intervening connective tissue is free, retain a certain degree of mobility. The inferior contour of the tumor is of diagnostic value. In the case of peritonitic exudates it is round or oval, corresponding to Douglas' space, and sharply defined; whereas retro-uterine connective tissue exudates are continued downward into the rectovaginal septum and accordingly have a conical lower extremity. They also extend further down than exudates in Douglas' space and more to one side, as far as the pelvic wall. The most important point in my opinion is the relation of the exudate to the rectum. As the rectum is extraperitoneal at the level of Douglas' space and surrounded only by the paraproctitic connective tissue, a tumor in Douglas' space, whether it be an exudate or a hematocele, merely displaces the rectum to one side without surrounding it. On the other hand, a parametritic exudate surrounds the rectum, causing a circular constriction, and is immovably attached to the mucous membrane. The only way to recognize these different conditions is by a rectal examination. If the tumor merely causes bulging of the rectal wall on one side and crowds the rectum over to the pelvic wall, while the mucous membrane remains movable, the condition is usually an exudate in Douglas' space; but if the tumor surrounds the rectum like a ring and causes a general narrowing, or the anus is represented by a round hole which looks as if it had been punched out, and the membrane is immovable, the probabilities are in favor of a parametritic exudate. The relation of the tumor to the posterior wall of the uterus may decide the diagnosis. The exudates of pelvic peritonitis know no boundaries and are attached to the posterior wall of the uterus as far as its peritoneal covering—that is, up to the fundus and beyond; while an extraperitoneal exudate ceases at the boundary line between the loose and firm attachments of the peritoneum and leaves the upper half of the body free. The consistency is characteristic unless the condition is very old. Peritonitic exudates are usually soft, cystic and fluctuating, while parametritic exudates early become hard and unyielding. In cases of old, inspissated exudates the distinction is more difficult. With regard to the clinical course, it must be stated that peritoneal exudates are found to be more frequently accompanied by vomiting, meteorism, and spontaneous pain; whereas these symptoms, especially the pain, are usually absent in parametritis.

Diagnosis of Certain Special Conditions.

The prognosis in parametritic exudate depends on whether the exudative process is arrested and the exudate absorbed, or suppuration takes place because the microörganisms present are particularly virulent or the general and local powers of resistance are not sufficient. As surgical intervention becomes necessary unless the pus spontaneously finds its way to the surface or into a hollow organ, the physician in charge of the case must decide the following questions:

1. Whether the exudate is being absorbed.
2. Whether suppuration has taken place.
3. Whether perforation is impending or has already occurred.

In most cases the question can be solved by a careful examination or by keeping the patient under observation.

FIG. 298.—INTRALIGAMENTARY PARAMETRITIC EXUDATE IN PROCESS OF ABSORPTION. P.-F. ⅓. (Original.) The main mass of the exudate still occupies the middle of the ligament; the connection with the uterus is somewhat thinner, and the attachment to the pelvic wall has disappeared except for a thick cord in the infundibulopelvic ligament.

Absorption can be determined objectively by certain changes in the shape of the exudate. As it is always more active at the periphery and in the thinnest portions, the exudate contracts toward the main mass, which is always the last to undergo absorption, that is to say, toward the pelvic wall or, in the case of intraligamentary exudates, toward the uterus. Again, the tumor may be divided into several portions by absorption of the connecting bridges of tissue. Absorption causes a tendency to increase the cavity of the vagina by drawing the vaginal vault upward. Through the rectum firm constrictions are felt instead of a bulging. As absorption begins at the periphery, the processes in the tumor are the first to retract, causing disappearance of the more slender connections with the individual organs, while the more robust masses of infiltrated tissue at first persist; as a result exudates in the horizontal portion of the parametrium may lose their connection with

the uterus and have a broad, flat, triangular area of contact with the pelvis, while the median portion of the pelvic connective tissue is already free. If absorption continues, the exudates retract more and more from the pelvic wall and simulate pelvic anomalies, such as obliquely contracted pelvis, exostoses, and pelvic tumors. Less frequently the connection with the pelvis is the first to disappear, and the exudate retracts toward the uterus. This is rather more frequent in cases of intraligamentary exudates (Fig. 298), which often appear as round tumors on the lateral wall of the uterus and simulate myomata. Parametritic exudates on the iliac bones or in the abdominal walls lose their thin connection with the uterus, and it becomes difficult to demonstrate their origin in parametrial tissue. The patient's general condition during absorption is usually good. The woman looks well, although somewhat debilitated; the appetite is good, and there are no local symptoms. Fever is usually absent altogether, although slight elevations of temperature may occasionally be present.

Suppuration of the exudate causes small immovable foci. These gradually coalesce and form in the interior of the exudate large and small pus foci, which gradually cause further liquefaction of the tissue and reach the surface. So long as the suppuration is confined to the interior of the exudate it does not betray itself by any open change. Fluctuation is absent in this stage because the focus is surrounded by thick, hard masses of tissue; occasionally a slight degree of sensitiveness on deep pressure is present, and the hyperemia in the adjoining mucous membrane is increased.

Suppuration of the Exudate.

The diagnosis of this stage of suppuration is based chiefly on the general condition. The patient emaciates, becomes weak, loses her appetite, and looks pale and faded. These symptoms are all due to the absorption of toxins. Fever is almost always present. As recent exudates properly treated rarely suppurate primarily, the fever usually falls after from 6 to 10 days and, if it returns after an afebrile interval of variable length and exhibits a distinct remittent and intermittent character, it is suggestive of suppuration. Primary suppuration is rare; but if the tumor persists over two weeks and is not explained by the further spread of the exudate, suppuration is very probable. The leukocytosis which accompanies suppuration is a valuable diagnostic sign.

In 24 cases of simple parametritic exudates in my service the leukocyte counts were:

In 12 cases of purulent exudates in which the presence of pus was demonstrated by incision or perforation, the number of leukocytes was from 11,500 (minimum) to 34,000 (maximum).

The highest figures showed the following distribution:

0 to 10,000 leukocytes	None.
10,000 to 20,000 leukocytes	6 times.
20,000 to 30,000 leukocytes	4 times.
30,000 to 40,000 leukocytes	Twice.

The lowest figures (in cases counted more than once) were distributed as follows:

0 to 10,000 leukocytes	None.
10,000 to 20,000 leukocytes	8 times.
20,000 to 30,000 leukocytes	Once.
30,000 to 40,000 leukocytes	None.

Hence the leukocyte count never falls below 10,000 when suppuration is present; it exceeds 20,000 in about half the cases; and may in any case fall below 20,000.

In 12 cases of exudate in which suppuration was excluded by the occurrence of complete absorption, the leukocyte count was from 7000 (minimum) to 24,800 (maximum).

The highest figures show the following distribution:—

0 to 10,000 leukocytes	Once.
10,000 to 20,000 leukocytes	9 times.
20,000 to 30,000 leukocytes	Twice.
30,000 to 40,000 leukocytes	None.

The lowest figures (in cases counted more than once) were distributed as follows:

0 to 10,000 leukocytes	Once.
10,000 to 20,000 leukocytes	4 times.
20,000 to 30,000 leukocytes	None.
30,000 to 40,000 leukocytes	None.

Hence in exudates that do not go on to suppuration the leukocytes never exceed 30,000 (very probably 25,000); they rarely rise above 20,000; and usually fluctuate between 10,000 and 20,000. Finally a normal count of leukocytes is rarely observed.

The following diagnostic conclusions may be deduced from my blood counts: Suppuration is certainly present if the leukocytes number 30,000, and very probable if they are as high as 20,000. With a leukocytosis of from 10,000 to 20,000 suppuration is quite as probable as absorption. A leukocyte count of less than 10,000 excludes suppuration; hence leukocytosis is a positive sign only when the number obtained is either very high or very low. It is almost needless to say that in interpreting leukocytosis all other conditions which tend to increase the number of leukocytes, such as a recent puerperium, anemia and the like, and all physiologic causes must be excluded. It must also be remembered that in the case of recent exudate a great increase of leukocytes merely represents the reaction to the infection and does not at that early period indicate suppuration. Finally, even a moderate leukocytosis, if it persists, is more or less suggestive of suppuration.

Leukocytosis is particularly valuable in the afebrile cases. Among my cases of exudations that were undoubtedly suppurative, one had a normal temperature with a leukocyte count of 13,000 and in another, in which the temperature rose to 38° C., the leukocytes numbered 22,000. In one case in which the elevation was moderate and did not positively indicate suppuration, the diagnosis was decided by a leukocyte count of 34,000.

Hence within certain limits the leukocyte count is a useful aid in the diagnosis of suppuration of a parametritic exudate.

Rupture of the Exudate. If the pus accumulates in the exudate and causes liquefaction at the periphery, rupture to the outside takes place, the pus following the shortest path along the line of least resistance through the neighboring connective tissue. There are accordingly a number of characteristic sites of rupture for the various situations of the exudate. An exudate on the iliac bone ruptures above Poupart's ligament. The same site is selected by exudates situated high up between the layers of the broad ligament, which have a tendency to elevate the anterior layer. Exudates situated posteriorly in the

parametrium rupture into the rectum, or rarely on the buttock, at the lower edge of the gluteus maximus, reaching that point through the great sciatic notch. Exudates in the anterior paravesical tissue usually rupture into the bladder; while exudates in the retrocervical tissue rupture into the vagina or sometimes on the perineum, which they reach by traveling downward along the vagina.

During the preparatory stage of rupture certain changes take place in the affected organs which make the diagnosis of impending perforation possible.

Rupture through the abdominal walls produces the symptoms of simple subcutaneous abscess, with reddening of the skin, bulging and fluctuation; before the appearance of these symptoms gaps (lacunæ) in the tissue may be palpable.

Rupture through the rectum is usually preceded for a few days by constant tenesmus and the discharge of an abundant glairy mucus. At this time the rectal mucous membrane is tensely stretched by the bulging exudate, swollen and edematous, with all its folds obliterated, and at one point the exudate appears soft and impressible. Rupture is immediately followed by evacuation of a large quantity of pus, and later the discharge continues in small quantities mixed with feces. The opening is often so small and fistulous that it cannot be felt and may be recognizable only by its edges or as a minute retraction.

Rupture through the vagina is generally preceded by a marked bulging of the posterior wall, which is livid and feels soft and succulent. After evacuation of the pus the tumor collapses and the opening often conceals itself among the folds of the posterior vaginal vault, where it is recognized later in the speculum by the escape of the pus.

Rupture into the bladder reveals itself by very striking changes in the bladder wall. Exudates in the neighborhood of the bladder cause a bulging of the bladder wall, which may reduce the lumen to a mere slit. At first the prominence is covered by smooth mucous membrane; but as soon as the inflammation approaches the bladder wall, it produces circulatory disturbances and the mucous membrane is thrown into folds of normal color. In some cases the folds become edematous, swollen, and covered with small vesicles, due to separation of the epithelium. The vesicles are transparent and produce remarkable cystoscopic pictures (Fig. 299). Kolischer aptly calls it bullous edema.

Case 30.—Mrs. L. On the left side, in close contact with the bladder, is a hard tumor about the size of the fist, intimately attached to the left wall. Cystoscopy shows an otherwise normal vesical mucous membrane and striking changes in the part immediately adjacent to the exudate. The wall bulges toward the interior of the bladder, and the mucous membrane is thrown into thick parallel folds; a few of these folds have a vitreous, translucent appearance and are covered with small, transparent vesicles. The mucous membrane is pale and in some places covered with small petechiæ.

When rupture takes place, the pus is discharged with the urine, first in large quantities and later only as a sediment. The cystoscopic image changes accordingly. Either a large hollow with a ragged edge, or a small fistulous opening at the apex of a prominence, discharging a small stream of pus (Fig. 300), is seen. Before and after the abscess breaks the patient complains of violent bladder symptoms.

The diagnosis of **various kinds of parametritis** with reference to the microörganisms which produce them, and certain peculiarities depending upon accidental causes, is not unimportant because it has a considerable influence on the prognosis.

Septic puerperal parametritis, due to infection with streptococci and staphylococci, is characterized by a marked tendency

FIG. 299.—MUCOUS MEMBRANE OF THE BLADDER IN RUPTURE OF AN EXUDATE. The mucous membrane is thrown into folds and covered with bullous edema. (Modified after Zangemeister.)

FIG. 300.—CYSTOSCOPIC PICTURE OF AN EXUDATE THAT HAS RUPTURED INTO THE BLADDER. On the right wall, which projects into the lumen of the bladder, there is a spherical prominence, from the conical apex of which pus is discharged. (Modified after Zangemeister.)

to spread, which is made possible by the softening of the tissue and abundant production of tissue juice. Extensive exudates result, localized preferably in the broad ligament, and extending from that situation to the iliac bone. Under suitable treatment the tendency to suppuration is slight; in most cases rapid and complete absorption takes place.

Septic non-puerperal parametritis is rarely localized in the broad ligament and on the iliac bone. The exudate is usually in the immediate neighborhood of the organ or wound from which it originated. There is much less tendency to extension, and the exudate is accordingly smaller. Suppuration is much more frequent than in the puerperal form. Absorption occurs later, runs a slower course, and is rarely complete.

Gonorrheal parametritis has the least tendency to spread. The exudates are usually small and run a slow course. They cannot be distinguished from the preceding by palpation, but absorption is

very slow and incomplete. The diagnosis of gonorrheal parametritis can be made only by the association with pyosalpinx and by demonstrating the existence of gonorrhea in the genital organs.

II. Parametritis Retrahens.

Parametritis retrahens is a chronic inflammation of the pelvic connective tissue which at the very outset manifests thickening and cicatricial contraction. It is localized almost exclusively in the posterior portions of the parametrium, especially in the two folds of Douglas (posterior parametritis). There is rarely any tendency to spread, although the adjacent connective tissue and that of the infundibulopelvic ligament are frequently attacked along with the folds of Douglas. Displacement of the uterus, due to traction on the cervix, is a constant result of this form of parametritis and is the most prominent change observed by palpation. In bilateral parametritis retrahens the uterus is in retroversion; if the process is confined to one side, or at least one side is chiefly affected, the cervix is displaced backward to the side of the lesion with the production of lateroversion of the uterus and rarely torsion. If the connectivet issue in the infundibulopelvic ligament is attacked, the ligament contracts and the ovary is fixed to the pelvic wall. I have designated this condition paraoöphoritis. In rare cases the entire horizontal layer of connective tissue contracts and there is atrophy of the genital organs (parametritis atrophicans, Freund, Sr.).

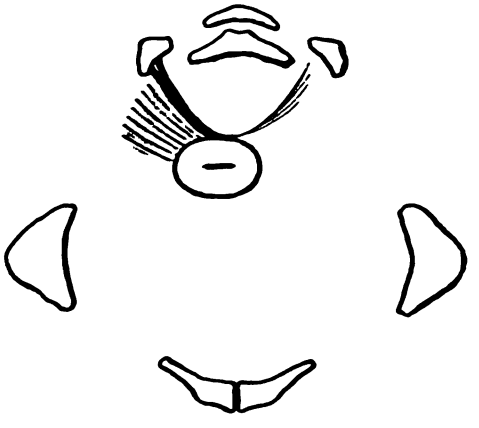


Fig. 301.—Parametritis Retrahens. P.-F. ½. (Original.) The right fold of Douglas and the connective tissue in front of it are contracted, and the cervix is accordingly displaced to the right.

Diagnosis. The first thing that is noticed in bimanual examination is the displacement of the uterus. If it is found that the uterus is also fixed in its abnormal position, it must be determined whether the fixation has taken place in the body or in the cervix.

Diagnosis.

In uncomplicated parametritis retrahens Douglas' space is entirely free and the body is movable in all directions; but if the posterior vaginal vault is pushed upward and brings the cervix forward, we find the structure fixed either posteriorly or on one side (Fig. 301), and the stretching of the adhesions causes pain. The direction in which the movement of the cervix is impeded and painful will indicate the

seat of the infection. The parametrium on the affected side is very much shortened and thickened, in recent cases somewhat doughy and swollen, and, when the process has existed for some time, tense and fibrous. The vaginal vault is often quite unyielding, as if it also were infiltrated. In typical cases of double posterior parametritis we find the entire posterior vaginal vault tense and, if the folds of Douglas are put on a stretch with the internal fingers after pushing the vaginal portion forward and at the same time forcing the vaginal vault upward, two rigid cords uniting at an acute angle behind the cervix are distinctly felt. These cords are felt very much more easily by introducing the finger high up through the rectum, especially under anesthesia; they appear as tightly stretched folds that come together behind the cervix, and are usually joined in front by several diffuse adhesions. The diagnosis of posterior parametritis is much more easy if the examination is made through the rectum. In para-oöphoritis the ovary is found attached to the pelvic wall by a single cord of the contracted infundibulopelvic ligament, leaving a certain degree of mobility; traction on the contracted ligament causes pain. Quite often both folds of Douglas and both infundibulopelvic ligaments are diseased, probably as a result of the simultaneous extension of chronic inflammatory processes from the uterus to these four lymphatic regions. In these cases four characteristic painful zones are present—in the two folds of Douglas and in the tissue between each ovary and the pelvic wall.

When the entire mass of pelvic connective tissue undergoes cicatricial contraction, the entire horizontal layer of connective tissue is tense and fibrous, and often as hard as a board. The uterus is displaced somewhat upward and completely fixed. It appears small and atrophic (parametritis atrophicans).

In exudative parametritis after perforation, evacuation or incomplete absorption, cicatricial brawny thickening of the connective tissue may remain and cause displacement of the uterus; but the adhesions are not so strictly limited to the posterior quadrants and the two folds of Douglas, being found wherever there is exudate. They are also less cord-like, more flat, diffuse and usually quite hard and unyielding, occupying large portions of the parametrium.

The diagnosis of this exceedingly common disease, which is very troublesome on account of the many symptoms to which it gives rise, produces very slight palpatory changes, and the diagnosis is not as a rule made by the general practitioner. Failing to find any gross lesions of the genitalia such as he is familiar with, he puts the patient down as nervous and hysterical and treats her accordingly. But a knowledge of the symptoms alone is often enough to indicate the diagnosis of this disease. The patient complains chiefly of pain coming on in positions

and during occupations which cause displacement of the uterus on account of the traction on the diseased ligaments with which they are associated; for example, the pain is brought on by jumping, or bringing the feet down forcibly on the ground, lifting, reaching out, turning, during coitus and defecation. In these cases the patient should be carefully examined for disease of the above-mentioned ligaments by pushing the posterior vaginal vault upward and at the same time forcing the vaginal portion forward. The lateral portion of the parametrium and the two infundibulopelvic ligaments must also be examined. In this way the cause of the symptoms is found very much more frequently than is generally believed in changes which are exceedingly slight and seem to have no direct connection with the symptoms. Sometimes it is impossible to make out any changes in the tissues, and one must be content with finding definitely localized pain on pressure.

Differential Diagnosis. Mistakes are made more often in the direction of overlooking this commonest of all abdominal infections than in mistaking it for other conditions. Nevertheless mistaken diagnoses do occur. The pain produced in the diseased folds of Douglas by displacing the vaginal portion is sometimes erroneously referred to the vaginal portion itself, or to the vaginal vault, because the delicate changes in the ligaments are not detected by palpation. Pain produced in the infundibulopelvic ligament may be erroneously referred to the ovary, which the examiner holds between his fingers at the time the ligaments are stretched. Not infrequently one has to distinguish between parametritic and perimetritic adhesions. The latter may be situated anywhere in the neighborhood of the uterus, especially near the adnexa; while the former are always around the cervix and very close to the vaginal vault. The former are more numerous, while in posterior parametritis only the two cords corresponding to Douglas' folds can be felt. Parametritic adhesions are very tense, tendinous, cicatricial, and cannot be torn, while perimetritic bands are delicate, often as fine as a spider's web, and tear at the slightest touch. Cervical parametritis causes fixation of the cervix, which is attached by connective tissue; while in perimetritis the body of the uterus is fixed at some point where it is covered with peritoneum.

Diagnosis of Uterine Catarrh.

Definition. Catarrh, or inflammation of the mucous membrane, is a term applied to a group of diseases characterized pathologically by hyperemia and the deposition of inflammatory products in the form of exudates or young embryonal cells in or upon the mucous membranes, and, in chronic conditions, accompanied by multiplication and enlargement of the constituent elements of the mucous membrane. Clinically, catarrh manifests itself in an increased activity of the mucous membrane and its individual constituents, and in a number of symptoms which arise directly or reflexly from the altered mucous membrane or its inflammatory products.

Definition.

Classification. Catarrh may occur in any portion of the mucous membrane, from the vulva to the abdominal extremity of the tube. The various forms are classified as follows:

Vulvitis, or catarrh of the mucous membrane of the vestibule and introitus vaginæ.

Colpitis or vaginitis, catarrh of the mucous membrane of the vagina, from the hymen to the external os.

Endometritis, or catarrh of the mucous membrane of the uterus, from the external os to the uterine orifices of the tube. This is further subdivided into:

Cervical endometritis or catarrh, when the mucous membrane from the external os to the internal os is diseased, and

Corporeal endometritis when it affects the mucous membrane from the external os to the uterine orifices of the tubes.

Endosalpingitis, or inflammation of the mucous membrane of the tube.

Catarrh is rarely limited to one of these subdivisions of the genital tract and has a great tendency to spread from below upward, or, if it begins above, downward to the lower segments. For this reason catarrh of the mucous membrane must be regarded as a connected entity; but, owing to distinct structural and physiologic differences in the various portions of the mucous membrane, the pathologic and clinical pictures produced in them are quite different. For this reason we shall first describe the individual sections separately, and later discuss the disease as a whole from the common standpoint. While I shall

and during occupations which cause displacement of the uterus on account of the traction on the diseased ligaments with which they are associated; for example, the pain is brought on by jumping, or bringing the feet down forcibly on the ground, lifting, reaching out, turning, during coitus and defecation. In these cases the patient should be carefully examined for disease of the above-mentioned ligaments by pushing the posterior vaginal vault upward and at the same time forcing the vaginal portion forward. The lateral portion of the parametrium and the two infundibulopelvic ligaments must also be examined. In this way the cause of the symptoms is found very much more frequently than is generally believed in changes which are exceedingly slight and seem to have no direct connection with the symptoms. Sometimes it is impossible to make out any changes in the tissues, and one must be content with finding definitely localized pain on pressure.

Differential Diagnosis. Mistakes are made more often in the direction of overlooking this commonest of all abdominal infections than in mistaking it for other conditions. Nevertheless mistaken diagnoses do occur. The pain produced in the diseased folds of Douglas by displacing the vaginal portion is sometimes erroneously referred to the vaginal portion itself, or to the vaginal vault, because the delicate changes in the ligaments are not detected by palpation. Pain produced in the infundibulopelvic ligament may be erroneously referred to the ovary, which the examiner holds between his fingers at the time the ligaments are stretched. Not infrequently one has to distinguish between parametritic and perimetritic adhesions. The latter may be situated anywhere in the neighborhood of the uterus, especially near the adnexa; while the former are always around the cervix and very close to the vaginal vault. The former are more numerous, while in posterior parametritis only the two cords corresponding to Douglas' folds can be felt. Parametritic adhesions are very tense, tendinous, cicatricial, and cannot be torn, while perimetritic bands are delicate, often as fine as a spider's web, and tear at the slightest touch. Cervical parametritis causes fixation of the cervix, which is attached by connective tissue; while in perimetritis the body of the uterus is fixed at some point where it is covered with peritoneum.

Diagnosis of Uterine Catarrh.

Definition. Catarrh, or inflammation of the mucous membrane, is a term applied to a group of diseases characterized pathologically by hyperemia and the deposition of inflammatory products in the form of exudates or young embryonal cells in or upon the mucous membranes, and, in chronic conditions, accompanied by multiplication and enlargement of the constituent elements of the mucous membrane. Clinically, catarrh manifests itself in an increased activity of the mucous membrane and its individual constituents, and in a number of symptoms which arise directly or reflexly from the altered mucous membrane or its inflammatory products.

Definition.

Classification. Catarrh may occur in any portion of the mucous membrane, from the vulva to the abdominal extremity of the tube. The various forms are classified as follows:

Vulvitis, or catarrh of the mucous membrane of the vestibule and introitus vaginæ.

Colpitis or vaginitis, catarrh of the mucous membrane of the vagina, from the hymen to the external os.

Endometritis, or catarrh of the mucous membrane of the uterus, from the external os to the uterine orifices of the tube. This is further subdivided into:

Cervical endometritis or catarrh, when the mucous membrane from the external os to the internal os is diseased, and

Corporeal endometritis when it affects the mucous membrane from the external os to the uterine orifices of the tubes.

Endosalpingitis, or inflammation of the mucous membrane of the tube.

Catarrh is rarely limited to one of these subdivisions of the genital tract and has a great tendency to spread from below upward, or, if it begins above, downward to the lower segments. For this reason catarrh of the mucous membrane must be regarded as a connected entity; but, owing to distinct structural and physiologic differences in the various portions of the mucous membrane, the pathologic and clinical pictures produced in them are quite different. For this reason we shall first describe the individual sections separately, and later discuss the disease as a whole from the common standpoint. While I shall

begin with the upper portion of the tract, I shall for the present omit endosalpingitis, because it is the most important of the tubal diseases and has already been discussed in the chapter devoted to that subject.

Endometritis.

The term endometritis embraces a number of conditions with entirely different pathologic and clinical pictures, with such great differences in their etiology, pathology, and symptomatology that their localization in the endometrium is their only connecting link. Hence, for didactic as well as for practical purposes, a subdivision of endometritis would be most desirable and, apart from the obvious classification into acute and chronic, circumscribed and diffuse forms, attempts have been made to base a classification on general principles. The most obvious and logical is the anatomic classification suggested by Ruge, who subdivides endometritis into glandular, interstitial and diffuse, besides the minor forms—decidual, post-abortum, and exfoliating endometritis. But for diagnostic purposes and for general practice this classification is useless, chiefly because it presupposes a microscopic examination, which cannot be made for diagnostic purposes, but must be delayed until treatment (in the form of operation or curettage) has been applied, and because the various pathologic pictures have no corresponding definite clinical conditions. Winckel proposes an etiologic classification of endometritis. There is no doubt this is the most correct from the scientific standpoint; but, aside from the fact that many of his twelve varieties are not as yet generally accepted, an etiologic division is for the present useless for diagnostic purposes because it is either impossible to recognize the cause, or its detection requires complicated methods of examination. For practical purposes a classification based on the three main symptoms,—hemorrhage, pain and discharge—into hemorrhagic, dysmenorrheic and catarrhal endometritis would be satisfactory, were it not that many cases present several symptoms in equal severity, and that a change from one symptom to another is often observed. In the present state of gynecologic diagnosis it seems to me better to abandon all attempt at classification and to view endometritis as a whole, except those forms which our present knowledge of diagnosis enables us to separate from the general picture of endometritis, such as gonorrheal, exfoliating, and fungous endometritis, which will be treated separately in the appropriate place.

Diagnosis.

In the diagnosis of endometritis we have to pursue a different method from that used in other diseases. Relying less upon the physical signs, we base our diagnosis chiefly upon the symptoms. The reason

for this is that endometritis has no physical signs, the changes in the uterine cavity being quite insignificant; while, on the other hand, the symptoms are so characteristic and may produce such a clear clinical picture, that the diagnosis is often possible without examining the patient. I shall, therefore, reverse my usual method in the case of endometritis, and begin with the symptoms instead of the physical signs. It should be emphasized, however, that the patient's statements are not always reliable, particularly in the matter of hemorrhage and leucorrhea, which must be demonstrated objectively whenever possible.

The most prominent symptom is hemorrhage, which usually takes the form of a menorrhagia, rarely occurring between the periods. The quantity of blood lost during the menses may be increased or diminished; since the quantity varies between wide limits in perfectly healthy women, it is difficult to say what quantity is "too much." If the patients state that the flow has become considerably more profuse than formerly, or that it takes a number of days, often from one to two weeks, to recover from the loss of blood, or that they "bleed very freely," that it "pours," "comes in a rush," or that they "float away," the hemorrhage may be regarded as pathologic. Blood clots are also a sign of very excessive hemorrhage. The duration of menstruation may be prolonged in endometritis. As here again we have no definite standard, and the period varies from two to eight days in healthy women, this symptom can be regarded as pathologic only if the period exceeds the above extreme, if the bleeding does not cease at all, or the period lasts considerably longer than had previously been the case. Menstruation rarely begins at the normal time; usually the intermenstrual periods are shortened, and the flow recurs every three weeks, or every two weeks, instead of four weeks—"twice a month." This may sometimes alternate with periods of amenorrhea lasting from two to three months, particularly after a severe hemorrhage. Intermenstrual hemorrhage is, on the whole, more rare, but may occur after coitus, psychic emotion or bodily exertion. The patient usually states that the trouble has developed slowly, and increased gradually during a period of months or years; more rarely there is a history of severe menorrhagia occurring immediately after a normal menstruation.

Hemorrhage.

A less common, but no less important symptom of corporeal endometritis is leucorrhea.

While the normal endometrium has no characteristic secretion, simple corporeal catarrh is accompanied by a seropurulent discharge. In acute conditions the discharge is seropurulent mixed with blood, and may consist entirely of pus; but in the chronic catarrhal forms the discharge is always more thin and purulent (seropurulent). Mucus is entirely absent in simple corporeal catarrh, and occurs only when the

cervix is also diseased. The quantity of discharge is extremely variable; there are some forms of endometritis with violent symptoms in which there is very little secretion, while in other cases the flow is quite profuse. The most abundant secretion is seen in the gonorrheal forms, particularly during pregnancy. The discharge is usually increased before and after menstruation; at times it may be altogether absent, or at least cease for a time. As a rule there is no odor; but sometimes, owing to the presence of the metabolic products of microörganisms, the discharge is very offensive. If the endometritis is associated with catarrh of the cervix and of the vagina, the corporeal secretion becomes mingled with the secretions of these two structures and loses its characteristic properties. In cases of this kind it is particularly difficult to identify the discharge as corporeal secretion. To begin with, it is not easy to determine whether a discharge which is found in the vagina has been secreted by the vaginal mucous membrane or has come down from the uterus, particularly as the secretion of the body and that of the vagina may be quite similar. If the inspection with the speculum happens to be made at the instant when the secretion escapes from the external os, the question is decided at once; but in the majority of cases special methods must be resorted to in order to obtain this information. If it is to be decided whether the uterine secretion is a product of the body or of the cervix, it becomes imperative to separate it from the vaginal secretion, so as to be able to investigate its special properties. For this purpose Schultze's tampon (Fig. 302) is employed. It consists of loose cotton, sufficiently broad and not too thick, tied crosswise in both directions with a thread; it is better not to leave the thread long for the purpose of removing the tampon. The tampon is employed as follows: The vaginal parts having been exposed with a Simon speculum, the secretion adhering to the outer surface of the entire vagina is gently removed, taking care not to make the mucous membrane bleed because, if the secretion obtained for the purpose of examination is mixed with blood, the diagnosis is obscured. The tampon is then placed in front of the vaginal portion so that the os is exactly opposite the intersection of the threads, and pressed firmly into the vaginal vault, so that its position shall vary as little as possible. If the secretion is very abundant, the tampon loosens prematurely; if the vagina is very wide and relaxed, it is apt to fall out. Under these circumstances it is better to place a second tampon in front of the first. After twenty-four hours the tampon is removed by exposing the cervix as before in the Simon speculum, and seizing the lower extremity of the tampon with forceps.

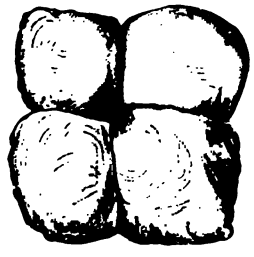


FIG. 302.—SCHULTZE'S (DIAGNOSTIC) TAMPON.

NOTE. Schultze recommends that the tampon be saturated with a 20 to 25 per cent. solution of tannin in glycerin. After numerous experiments, I have satisfied myself that it is better to use a dry tampon for the following reasons: In the first place the abundant watery secretion induced by the glycerin is disturbing; and in the second place small quantities of mucus become so inspissated that they cannot be recognized with certainty. Another reason is that the glycerotannin irritates the vagina and causes a desquamation of abundant squamous epithelium, which renders the secretion cloudy, and makes it difficult to decide how far the desquamation is due to the catarrh. Mucus and pus are difficult to distinguish, and it is not easy to determine whether the cervical secretion is glairy, or turbid from the presence of pus and epithelium.

In normal genitalia the spot in front of the external os where the tampon was placed will be covered with a small quantity of glairy mucus, and the cotton will be stained light yellow, while the periphery of the tampon is covered with a glistening layer of desquamated vaginal epithelium. With the aid of the tampon it is easy to decide whether the secretion is derived from the uterus or the vagina. The former is always near the intersection of the threads, while the vaginal secretion is deposited only at the periphery. A more difficult question to decide is whether the cervix or the body is the source of the secretion. Up to a certain point this can be determined by the character of the material. Mucus is always derived from the cervix, whereas pure pus is secreted by the body. It is to be remembered, however, that erosions or pure cervical pus around an erosion may produce a slightly yellow purulent discoloration of that part of the cotton which was in contact with the erosion. The diagnosis is most difficult when the tampon contains both mucus and pus. If the two materials are intimately mixed, it is probable that they were both secreted at the same time by the cervix and that the case is one of purulent cervical catarrh; but if pure pus and pure mucus are present and not intimately mixed, it is a positive sign that both the body and the cervix are diseased; and if, in chronic cases, there is much more pus than would correspond to the quantity of mucus, a combination of corporeal and cervical catarrh is probable. If the vaginal portion presents erosions, ovula Nabothi or ectropion, cervical catarrh is probably present; although, on the other hand, the absence of these changes does not exclude it. The quantity of pus that is found on the tampon in corporeal catarrh varies considerably, indeed pus may be altogether absent in undoubted cases of the disease; hence corporeal catarrh must never be excluded on the strength of a single negative examination, and the latter must be repeated, preferably at times when the secretion is usually more abundant, as before and after menstruation, or at the time of the intermediate pain. It is unnecessary to examine the secretion for pus microscopically; but if there is any suspicion of uterine gonorrhea, it is a favorable material for the demonstration of gonococci.

Another symptom of some value for the diagnosis is uterine pain. It has the character of labor pains and is described by

the patient as a suddenly occurring, intermittent, cramp-like pain, or as a dull pressure associated with bearing down and pressure on the bladder. As a rule, the pain is directly referred to the region of the uterus; although some women refer the pain more to the umbilical region, and occasionally also underneath the arch of the ribs. These labor-like pains are undoubtedly due to uterine contractions, which are painful on account of the inflammation of the endometrium, and occasionally that of the entire uterine wall. The pains are characteristic of endometritis only when they are associated with the function of the uterine mucous membrane, *i.e.*, with menstruation; while uterine cramps due to other causes frequently occur before and during the menstruation. (For the peculiarities of this endometritic dysmenorrhea, see the chapter on "Causes of Dysmenorrhea" in the part devoted to analytical diagnosis.)

Uterine Pains.

Much less frequently uterine pain in endometritis occurs in the form of intermediate pain, *i.e.*, it occurs midway between two menstruations, and is often associated with the periodically appearing leucorrhea. Sometimes uterine pain occurs quite irregularly during the intermenstrual periods, and is in that case probably due to retention of the secretions. Some women who do not complain of distinct pain mention all kinds of unpleasant sensations in the abdominal organs, such as persistent bearing down, a feeling of "swelling" and "thickness in the abdomen"; they "feel the womb"; they have an increased desire to defecate and urinate; they complain of pain in the abdomen, in the back and in both legs. These symptoms are considerably increased a few days before menstruation, or they occur only at that time, and are certainly associated with the process of menstruation. As compared with menorrhagia and leucorrhea, uterine pain is a purely subjective symptom for the interpretation of which we must depend solely on the sensations and statements of the patient. It should therefore be utilized with great caution, and in those forms of endometritis in which pain is the only symptom every effort should be made to obtain some objective signs.

Intermediate Pain.

Aside from these symptoms, which are quite definite and frequently constitute the only basis for the diagnosis of endometritis, there is another symptom-complex to be mentioned, which must be referred to the nervous system and the psychic condition of the patient. It is important for the diagnosis of endometritis because it is most intense during functional activity of the uterine mucous membrane, *i.e.*, during menstruation. From four to six days before menstruation the patient begins to feel languid, miserable, "completely done out," complains of dragging pains in all the limbs as if she had been beaten; she becomes nervous, irritable, easily excited

Premenstrual Symptoms.

and timorous; sleep is restless and interrupted by dreams, and the patient's entire temperament and disposition change. Women who are otherwise quiet and peacable complain that during this time they are quarrelsome, vicious, and "not fit for anyone to live with"; they also complain that they are unable to concentrate their thoughts. Some women become profoundly melancholic, lose all interest in life and even have thoughts of suicide. These psychic phenomena are sometimes observed in a milder form during the intermenstrual period also. The premenstrual symptoms, as they are called, represent an exaggerated degree of what healthy women feel before and during their menstrual periods, and their explanation is found in the premenstrual engorgement of the diseased endometrium; or, in the case of infectious catarrh, in the increased absorption of toxins. It is very difficult to distinguish between what is normal and abnormal, particularly in psychic symptoms. It should also be emphasized that these conditions are not exclusively symptomatic of endometritis, and that they occur also in metritis and in diseases of the tubes and ovaries; they are, however, more pronounced in endometritis, especially the catarrhal form, and have a diagnostic value from the fact that they point to disease of the uterine mucous membrane. Gastric symptoms—nausea and vomiting—which are frequent concomitants of endometritis, are sometimes the only symptoms complained of, to the entire exclusion of abdominal discomfort. When they are present, the endometrium should receive attention if no gastric cause can be found.

The above-mentioned symptoms have a very great value for the diagnosis of endometritis, but they are not pathognomonic. With the exception of leucorrhea, definitely proved to be derived from the body, they are symptoms that occur also in other diseases. For this reason an attempt should always be made to obtain some objective signs, and for this purpose the uterine cavity is examined with a sound. The finger is not so well adapted for discovering insignificant changes in the uterine mucous membrane as the small head of a sound in the hands of a skilful examiner. In a large number of cases the uterine cavity is greatly dilated, as shown by the large excursions and rotations in all directions that can be performed without difficulty with the sound. Dilatation of the cavity, it is true, is not found so frequently when the uterus contains abnormal matters, such as polyps or remains of abortions. In cases of subinvolution after operation, or labor, or in chronic relaxation of the muscle the value of this sign is rather limited. Irregularities of the surface, which are found most frequently in the fundus and adjoining portions of the body, are much more important; but this sign also is not pathognomonic, partly because irregularities are found also with carcinoma

Objective Signs of Endometritis.

and the retention of decidual tissue, and partly because a normal endometrium may occasionally show slight irregularities in its surface. On the other hand, the mucous membrane may be perfectly smooth in cases of extreme hyperplasia. Sometimes the examiner has a feeling as if the sound were sinking into the soft uterine mucous membrane, like the foot sinking into moss. Severe hemorrhage immediately after sounding also points to changes in the endometrium. The sense of roughness in the mucous membrane is most distinct in the fungous forms of endometritis, and is due to the gliding of the head of the sound over the prominences of the mucous membrane. A very important objective sign is marked tenderness of the endometrium during sounding. The tenderness is most frequently confined to the fundus or to the roughened areas and manifests itself as an intense, stabbing or spasmodic pain in the region of the uterus, around the umbilicus, or in the sacrum. The pain is sometimes so intense that the woman cries out, shrinks from the sound, or faints. The value of the symptom is impaired by the fact that nervous, timorous, and hyperesthetic women complain of pain even when the endometrium is healthy, and because perimetritic and parametritic pain, which is sometimes excited by sounding, is frequently mistaken for endometritic pain. To avoid this mistake the examiner should remember that the former is produced by the displacement of the uterus and the traction on adhesions incident to the introduction of the sound; whereas endometritic pain is elicited only when the head of the sound comes in contact with the mucous membrane. Hence in doubtful cases the sound should be allowed to remain for a moment in the uterine cavity after its introduction, and then slowly and cautiously advanced until it touches the mucous membrane. The sound must not be employed for the diagnosis of all forms of endometritis. The method is most suitable for those associated with severe hemorrhage and dysmenorrhea. In cases characterized by discharge, particularly purulent discharge, the sound should not be employed, and its use is strictly contraindicated in all cases with a suspicion of gonorrhea. As endometritis is frequently associated with perimetritis and parametritis, as well as with disease of the adnexa, the latter must be carefully examined before the sound is introduced.

There are no distinctive bimanual signs in endometritis, with the exception possibly of a slight softening of the mucous membrane of the vaginal portion, particularly in the fungous forms, and quite frequently a slight thickening of the body, due to associated metritis. The object of combined examination in the diagnosis of endometritis is rather to exclude any other possible causes for the symptoms. These are chiefly carcinoma, myoma, disease of the adnexa, and inflammation. It may serve to confirm the diagnosis of endometritis by yielding a negative result.

The most reliable method of making a diagnosis of endometritis is by means of a microscopic examination of the uterine mucous membrane. As the symptoms on account of their ubiquity have so little diagnostic value, and the objective findings are negative in endometritis, it would be of great advantage if we could make the diagnosis more certain by resorting to this method; but the general employment of exploratory curettage, or even the removal of a few particles of mucous membrane for purposes of examination, is impracticable for the general practitioner because, aside from the very great discomfort to the patient, there is danger of injuring the uterine wall, or even causing infection. Hence, except possibly in a few cases of special importance, we are forced to advise against this method, unless there is a suspicion of malignant disease. On the other hand, if the uterus has been curetted for therapeutic purposes, the mucous membrane should immediately be subjected to microscopic examination, the result of which will determine the subsequent treatment to be administered. Digital exploration of the uterus through an artificially dilated cervix is open to the same objections; it is much too painful to the patient, and not infrequently causes infection, hence its general employment for the diagnosis of endometritis is not to be recommended. Another disadvantage is that the palpating finger is not always capable of recognizing irregularities in the surface, which can easily be felt with the sound; although occasionally the finger feels the reflected surface of the swollen and softened mucous membrane. Hence digital exploration should be performed only when some special cause for the endometritis is suspected in the uterus, such as a submucous myoma.

Differential Diagnosis.

As the palpatory findings in endometritis are entirely negative, they cannot give rise to diagnostic errors. The source of error which may arise with the sound, in the matter of pain especially, has already been discussed. Clinically the differential diagnosis in endometritis is based on the symptoms, because these also form the foundation of the diagnosis.

In the main, therefore, it will have to be determined whether the hemorrhage may not be explicable by some other cause, such as carcinoma, myoma, or tubal inflammation. If all these diseases, which are characterized by definite physical signs, can be excluded—in other words, if the objective examination yields the negative result which is characteristic of endometritis—it will have to be determined further whether the hemorrhage may not be a purely symptomatic phenomenon due to some internal trouble, or a circulatory disturbance of a local or general nature. The etiologic diagnosis of uterine hemorrhage is so difficult and so important that I have discussed it in a special chapter

under Analytical Diagnosis, and as I have there shown under what conditions endometritis may be held responsible for the hemorrhage, I shall not discuss the point in detail in this place.

The same course is pursued with regard to the other symptom of endometritis—the uterine pain. Again we must exclude by careful bimanual examination all the causes of dysmenorrhea which are characterized by definite physical signs, such as myoma, disease of the ovaries and of the tubes; and if the result of the objective examination is negative, we shall have to inquire whether the dysmenorrhea is due to endometritis or to some other local or general disturbance. This important question is also discussed in the part devoted to Analytical Diagnosis, and I shall therefore not dwell on it in this place.

In those cases in which the diagnosis of endometritis has to be made chiefly by the increase in the uterine discharge, the tampon must be used in order to demonstrate that the discharge is derived from the uterus (see page 505). From hypersecretion, due to temporary functional disturbance, endometritis may be distinguished by the duration of the symptoms, and its association with local and general subjective symptoms (see above).

For the microscopic differential diagnosis of endometritis see page 540.

Diagnosis of the Various Forms of Endometritis.

I have already given my reasons for treating endometritis as a whole from the diagnostic standpoint instead of subdividing it into its various forms. Nevertheless a number of varieties can be separated from the general picture of endometritis, with definite etiologic, as well as pathologic and clinical characteristics, so that it is possible to describe them as separate diseased conditions of the endometrium. As it is important for the physician to know these forms, and to be able to identify them in a given case, I shall try so far as possible to define these individual varieties and to give their diagnostic features.

Acute septic (non-puerperal) **endometritis** is an infectious inflammation of the endometrium, due to the entrance into the uterine mucous membrane of microörganisms (streptococci, staphylococci, bacterium coli, and saprophytes). The diagnosis is based chiefly on the profuse discharge from the body, which may be serous, bloody, purulent, dirty from the admixture of tissue particles, and offensive or putrescent; and secondarily on general constitutional disturbances, more particularly fever. There are no characteristic physical signs, except moderate tenderness of the uterus and slight softening of the vaginal portion and vagina.

Acute Septic Non-Puerperal Endometritis.

Catarrhal endometritis is a chronic inflammation, the cause of which

must also be an infection of the uterine cavity with microörganisms, probably the above-mentioned microörganisms of wound infection. It is frequently secondary to the above form. The pathologic changes consist merely in hyperemia and infiltration of the mucous membrane. The diagnosis is based chiefly on the presence of a seropurulent secretion from the body, and in many cases on well-marked premenstrual symptoms, while menorrhagia and dysmenorrhea are more rare. Palpation and sounding yield negative results; roughness and endometrial tenderness are almost regularly absent. In these forms the use of the tampon is indispensable.

Catarrhal Endometritis.

Gonorrheal endometritis, due to infection with gonococci, is an inflammation accompanied by profuse purulent discharge, which usually begins acutely and runs a chronic course. The pathology is approximately the same as that of catarrhal endometritis. The clinical diagnosis is based on the finding of a purulent secretion from the body containing gonococci, or at least on the positive clinical demonstration of gonococci in every portion of the genitalia (see page 523). Hemorrhage may occur during the acute stage, and may be absent after the disease has become chronic. Premenstrual symptoms are almost never observed. There are no objective signs; sounding is contraindicated. On the other hand, if there is tubal disease, gonorrheal endometritis may be suspected.

Gonorrheal Endometritis.

Tuberculous endometritis is caused by infection of the uterine mucous membrane with tubercle bacilli. A positive diagnosis demands the demonstration of tubercles and tubercle bacilli in scrapings of the mucous membrane. The disease may be suspected in the presence of endometritic symptoms occurring in a tuberculous woman, particularly if the existence of tuberculous peritonitis and salpingitis, or of tuberculous ulcers in the vaginal portion, can be demonstrated. The symptoms are not characteristic, with the exception possibly of a cheesy, granular discharge. In advanced cases amenorrhea is frequently observed.

Tuberculous Endometritis.

Fungous endometritis is characterized pathologically by extreme hypertrophy of the mucous membrane of chronic, interstitial, glandular, or diffuse character; clinically it is distinguished from other forms by the severity and frequent recurrence of menorrhagia, the comparative rarity of dysmenorrhea, and the regular absence of leucorrhea. The diagnosis is based on menorrhagia associated with the demonstration of irregularities at the fundus, dilatation of the uterine cavity and, occasionally, bogginess or softening of the mucous membrane of the vaginal portion. Endometrial tenderness is usually absent; no information is to be obtained with the tampon. Exploratory curettage is permissible only if there is a suspicion of

Fungous Endometritis.

malignancy. A positive diagnosis frequently requires a microscopic examination of portions of the mucous membrane removed during a therapeutic curettage. The adnexa are usually free from disease.

Dysmenorrheic endometritis is characterized clinically by pain which is chiefly, or even exclusively uterine in character—particularly dysmenorrheic and intermediate pain—and by the absence of hemorrhage and discharge. The pathologic process is usually a chronic interstitial exudation, but glandular forms are also observed. The diagnosis is based on the existence of a uterine dysmenorrhea, extreme tenderness on pressure in the endometrium, irregularities in the mucous membrane, and occasionally contraction of the uterine cavity. The tampon gives no information and the palpatory findings are negative.

Dysmenorrheic Endometritis.

Exfoliating endometritis (dysmenorrhoea membranacea) represents a chronic inflammation of the uterine mucous membrane, characterized clinically as a rule by severe dysmenorrhea and always by the discharge of the uterine mucosa, in small pieces or coherent membranes, between the second and fifth day of menstruation.

Exfoliating Endometritis.

The diagnosis is based on the expulsion of an organized membrane during menstruation. In the differential diagnosis we must exclude membranous clots and croupous membranes, which are distinguished by their friability and the fact that they disintegrate spontaneously, especially when placed in water. If the expelled membrane is definitely identified as a piece of organized mucous membrane, it may be menstrual decidua, or the decidua of uterine or extra-uterine pregnancy. The distinction may be very difficult. If menstruation occurs at the regular time, and the membranes are expelled repeatedly at these times, the case is one of endometritis; but if a membrane is expelled only once, or only at very long intervals after menstruation has been delayed, even if only for a few days, the condition is more probably abortion or extra-uterine pregnancy. In many cases microscopic examination is necessary to establish the diagnosis (see page 529).

NOTE. Exfoliating endometritis in its symptoms and pathology closely resembles dysmenorrheic endometritis, of which it forms a subvariety. I have seen dysmenorrheic endometritis, after a considerable duration, converted into exfoliating endometritis.

Decidual endometritis is an inflammatory disease of the uterine mucous membrane which occurs during pregnancy. The diagnosis of this form of endometritis is particularly difficult, because examination of the uterine cavity is impossible at this time, and sole dependence must therefore be placed on the symptomatology. The symptoms also consist of hemorrhage, discharge,

Decidual Endometritis.

and uterine pain. The hemorrhage often occurs before it is possible to recognize the amenorrhea of pregnancy, and may persist often for several months; the severity is variable; the blood at times recent and venous; at others of a brownish color and mixed with mucus as the result of retention. Sometimes the discharge consists merely of a pinkish mucus. The secretion of the corporeal cavity is usually purulent and, in the case of gonorrheal forms, very abundant; occasionally a profuse watery flow is observed (hydrorrhea uteri gravidi). The tampon must be employed in order to determine the uterine nature of the discharge. Persistent pain of a distinctly uterine character may be present, or the labor pains of pregnancy. The latter are decidedly the most important symptoms of decidual endometritis, and for many months may constitute the patient's chief complaint. All the symptoms, particularly hemorrhage and discharge, are most prominent during the first half of pregnancy and disappear after the decidua vera and reflexa have united. The diagnosis of decidual endometritis is rendered more probable if endometritis is positively known to have been present before the beginning of pregnancy, or appears at least very probable from the patient's statements. Clinically, it is impossible in those cases in which no symptoms whatever are complained of during pregnancy, or before pregnancy began. Cases of this kind are not very rare, and abortion is then the only expression of the disease; but the diagnosis is probable only if repeated abortions occur, particularly during the early months. Examination of the expelled fetal membranes is the only certain method of arriving at the diagnosis, and they must therefore always be subjected to both macroscopic and microscopic examination if there is a suspicion of this disease.

Cervical Catarrh.

Definition. Cervical catarrh, or endometritis cervicis, is an inflammation of the cervical mucous membrane from the external os to the internal os, in the course of which inflammatory manifestations may also appear on the outer surface of the vaginal portion.

Diagnosis. The diagnosis of cervical catarrh is easier than that of endometritis, because part at least of the diseased mucous membrane can frequently be seen, and because the changes in the outer surface of the vaginal portion, which are easily recognized, occur only as the result of cervical catarrh. When the cervix is brought down into a Simon speculum, and the two lips everted with a tenaculum for the purpose of obtaining a better view, the mucous membrane appears bright red in color, soft and velvety. The outer surface of the vaginal portion, where the changes to be mentioned develop, is then inspected, as these changes are a positive sign of

Diagnosis.

an existing cervical catarrh. They consist of erosions, ovula Nabothi, mucous polyps, and ectropion with metritis colli.

Erosions are changes of the mucous membrane that cover the vaginal portion, consisting in exposure of the cylindrical epithelium after separation of the thick squamous epithelium which normally covers the structure. The diagnosis is very easy. The external os, which is usually somewhat dilated, is surrounded by a glistening surface of variable extent and continuous with the cervical canal, instead of by the normal, pale-violet squamous epithelium; the color ranges from a delicate pink in general anemia, to an intense scarlet in the presence of recent catarrh, or even purple if the condition is complicated by pregnancy. The surface is slightly roughened or furrowed; not sharply outlined at the periphery, but merging in an irregular manner with the surrounding squamous epithelium. In reparative processes islands of epithelium are occasionally seen at the centre of the erosion, or the entire area may be completely covered with a delicate squamous epithelium; but a healed erosion is much more purple in color than the more robust normal epithelium. The surface is covered with a mucoid secretion; erosions are often covered with a yellowish exudate and exhibit superficial ulcerations when the epithelium is lost. They bleed easily, sometimes spontaneously, and always when the surface is wiped off.

Erosions.

We distinguish simple erosion, with uniform, fairly smooth surface and without deep depressions; papillary erosion, in which the surface is irregularly nodular or marked by ridges with deep, regular depressions of glandular tissue into the vaginal portion; and follicular erosion, the entire surface of which, especially the peripheral portion, presents follicles in the form of yellow points or small cysts the size of lentils, which, when opened, discharge inspissated mucus or form small, roundish dimples, representing the remains of ruptured cysts.

Ovula Nabothi are small retention cysts which develop from the fundus of the glands of the cervical mucous membrane or of the erosion after constriction of the duct. At first situated more deeply, they become distended and reach the surface, being found most frequently around the healing erosion; they are frequently felt as small, circumscribed nodules which, when conglomerated, project above the level of the vaginal portion. To the eye they appear as circumscribed, small prominences, and the pale or yellowish contents are visible through the mucous membrane. If these retention cysts remain in the depths of the tissue they produce a circumscribed or general thickening of the vaginal portion; if the interglandular tissue also becomes hypertrophied, the condition is known as a follicular hypertrophy.

Ovula Nabothi.

In connection with chronic cervical catarrh there are found mucous polyps consisting of circumscribed hyperplasiæ of the cervical mucous membrane. If they are situated in the lower portion of the cervix, or project from the external os, they are both palpable and visible. The size varies from that of a pea to that of an egg, and the pedicle also varies in length. The surface is rarely smooth, usually lobulated, with a suggestion of division into several portions; lacunæ and large or small retention cysts are present. The consistency is soft; the mucous membrane glistening, of a bright red color, bleeding easily, and covered with mucus. Old polypi projecting into the vagina may be covered with squamous epithelium, but always retain a purplish color like that of a healing erosion.

Mucous Polyps.

The sequels of cervical catarrh in the form of chronic indurated processes in the cervical substance, known as metritis colli, are easily recognized by palpation. The entire surface becomes firm and hard, fibrous and unyielding, and the vaginal portion thick and shapeless. If there are bilateral cervical tears, the hypertrophied submucous tissue protrudes from the cervical canal and produces an ectropion, which is easily recognized by the broad, thick, shapeless vaginal portion, and the turned-over, mushroom-shaped lips, the anterior lip being often elongated like a snout. In the speculum the bilateral lacerations and the exposed cervical mucous membrane with its catarrhal changes, and the epidermidalization beginning at the margin, are seen. In bilateral lacerations the external os is felt and seen on one side elongated as far as the vaginal vault. The two edges of the lacerations are thickened and the seat of ectropion, and the cervical mucous membrane is exposed on one side only.

Metritis Colli and Ectropion.

Cervical catarrh in nulliparous women with contracted external os produces a peculiar picture. The small external os appears as a black point, because the cervix is filled with mucus and does not reflect the light. The mucus is retained, becomes inspissated, and dilates the cervical canal. The ampullary dilatation is easily recognized with the sound, and the inspissated mucus can be evacuated by pressing on the cervix.

In all cases of cervical catarrh, and particularly in those in which the changes just described are absent, examination of the secretion plays an important rôle; unless the secretion is found to be abnormal, a diagnosis of cervical catarrh is not admissible. The cervical secretion is obtained by bringing the cervix into the speculum and waiting until it flows from the external os, or by compressing the cervix with the two blades of a Simon speculum. If the secretion is scanty, it is better to insert a tampon; after twenty-four hours it will contain a quantity of secretion sufficient for diagnosis, and after its removal a larger quantity will be seen to flow out of the

Examination of the Secretion.

cervix. Normal cervical secretion is a glairy, viscid mucus. In catarrh various changes take place. In the first place, the quantity is altered, it may be increased and accumulate in the vagina, or stain the external genitalia and clothing; on the other hand, the secretion may become inspissated, so that there is no discharge whatever, or only a few particles are obtained. From the diagnostic standpoint the quantity of mucus contained in the secretion is most important. The cervix is the only portion of the genitalia that secretes genuine mucus, hence if an abnormal quantity of mucus is found, the cervix must be exclusively or chiefly diseased. The cervical secretion is viscid and forms threads from the edge of the external os to the speculum, or may be wiped off in long threads with cotton; it may be clear and watery, without any turbidity whatever, but is usually somewhat grayish from the presence of epithelial cells and leukocytes. Pus is the most frequent admixture, particularly in cases of infectious catarrh; the color of the mucus is changed, and may vary from a slightly yellowish tinge to a dark, yellowish-green color. Sometimes the quantity of pus is so abundant that the mucus, and with it the viscosity of the secretion, practically disappears. Occasionally a little blood is found in the secretion. In the catarrh of nulliparous women with contracted external os it is difficult to make a diagnosis by the secretion.

Differential Diagnosis. An abundant secretion from the cervical canal may be a symptom of inflammation or genuine change of the mucous membrane, or the production of a functional disturbance—a hypersecretion. The above-mentioned inflammatory changes of the cervical mucous membrane, especially erosions and ovula Nabothi, always point to catarrh, as does also the admixture of pus; but if the secretion consists solely of clear mucus, the diagnosis is more difficult. Pure hypersecretion is observed, for example, in pregnancy with tumors of the cervix, with inflammations in the neighborhood of the cervix, in congestive conditions of the abdomen, and very often in chlorosis.

Differential Diagnosis.

An erosion may be mistaken for a number of other affections of the vaginal portion. In cases of ectropion the everted cervical mucous membrane is often mistaken for an erosion, because in the speculum the external os, which forms the boundary between the cervical canal and the outer surface of the vaginal canal, is overlooked. The diagnosis between these two conditions depends on the position of the os; whatever is outside of the os is erosion, and whatever is behind it is cervical mucous membrane. To determine the position of the external os, the two lips of the cervix are seized at their outer surface with a double tenaculum, and then brought together again, restoring the shape of the vaginal portion; as this is done, the cervical mucous

membrane disappears from view in the interior of the uterus. In simple erosions the external os is usually much smaller, and the vaginal portion is not mushroom-shaped. The circumscribed redness which develops on the outer surface of the vaginal portion in cases of colpitis, bears a certain resemblance to an erosion; but it is usually arranged concentrically around the os, the surface is less velvety than that of an erosion, the condition representing merely a redness of part of the mucous membrane, with thinning of the epithelium. These areas bleed very easily, and a small quantity of pus is also found on the tampon.

For the differential diagnosis between erosions and carcinomatous, tuberculous and syphilitic ulcers, see page 352 *et seq.*

Colpitis.

Definition. Colpitis is a catarrhal inflammation of the mucous membrane of the vagina from the hymen to the external os.

The **diagnosis** of colpitis is based on the changes in the mucous membrane and the character of the vaginal secretion. It is quite easy except in those cases in which the speculum cannot be introduced, as in children, when the hymen is intact, or if there is vaginismus. In the acute form the mucous membrane is diffusely reddened, the color varying from pale red to flaming scarlet, and sometimes slightly purplish; the discoloration is uniformly distributed over the entire vagina, except in colpitis secondary to infectious cervical catarrh, in which the discoloration may be confined to the posterior vaginal wall in contact with the external os. The diffuse redness is usually associated with a linear and patchy hyperemia, produced by excessive injection of the papillary body. Very pronounced red patches are seen, especially in the upper portions of the vagina—the structures look as if they had been spattered with red ink—or red lines, or stripes corresponding to the elevation of the folds. In mild and chronic forms these red patches are the only manifestations of the changes in the mucous membrane. When the vaginal walls are separated with the speculum, a small drop of blood may escape from the red patches, or the surface may bleed when it is wiped off, or ecchymoses may be seen. These patches and ecchymoses are seen most distinctly in old women in whom the squamous epithelium is attenuated. The circumscribed hyperemia often leads to hemorrhages during examination; when the inflammation is more intense, the papillary body swells and the folds as well as the papillæ project at the level of the mucous membrane; these changes are more conspicuous in pregnant women. The inflammatory swelling, in association with the hypertrophy of pregnancy, produces thick granular proliferations on the mucous membrane (colpitis granularis).

Changes in the Mucous Membrane.

Occasionally chronic hypertrophy develops in the inflamed papillæ and condylomata acuminata are produced, forming small, wart-like prominences, with a rough white surface, which usually occur singly in the vagina or on the outer surface of the vaginal portion. In one case I saw minute warts springing from each papilla. The outer surface of the vaginal portion is also covered with red patches which bleed easily and throw off their epithelium (erosion of the vaginal type). In pregnant women, rarely in the non-pregnant state, vesicles containing gas develop in the mucous membrane under the action of gas-forming microörganisms (colpitis emphysematosa). These are found singly or in groups, usually on the posterior wall; in the speculum they are readily distinguished from swollen papillæ by the thin and desquamated epithelial covering; when they are punctured under water, gas is liberated.

In the rare cases of diphtheritic colpitis the vaginal wall, either in places or in its entirety, is discolored a dark gray or green, alternating with purplish portions, and later comes away in shreds.

The palpatory signs are of secondary importance to those obtained by inspection. In diffuse acute catarrh the mucous membrane feels uniformly soft and velvety, and is quite sensitive if the condition is acute. Swelling of the papillæ, especially in pregnancy, and the vesicles of emphysematous colpitis are also felt without difficulty. In senile colpitis cicatricial bands, the result of adhesions of the two vaginal vaults, or obliteration of the vaginal vault produce peculiar palpatory signs. On moderate pressure with the finger the adhesions tear with the production of a slight hemorrhage.

Examination of the secretion is important for the diagnosis. Whereas normally the vagina merely desquamates small quantities of epithelial cells, qualitative and quantitative changes in the secretion are found in every form of vaginal catarrh. The squamous epithelium may be desquamated in excess, forming small masses and, in the absence of fluid, appearing in the form of thick, white particles on the surface of the cervical mucous membrane. When these are removed, the mucous membrane underneath appears intensely reddened. In other cases serum is secreted from the vascular loops in the papillæ and, mingling with the desquamated epithelial cells, becomes whitish and more or less viscous. If cervical mucus is present, the epithelial cells appear as white particles; the serous fluid is derived from the vagina, while mucus is always of cervical origin. A milky, serous secretion is characteristic of the vagina. In acute, and especially in infectious forms, pus is superadded, and the secretion assumes a slightly yellowish color. The more acute the process, the yellower and more purulent the secretion. Pure pus in

Examination of the Secretion.

very large quantities is secreted in gonorrheal granular colpitis during pregnancy; if gas-forming microörganisms are present, the secretion becomes spongy. Purulent secretion is not characteristic of the vagina alone, as it may also be derived from the uterus. In most cases inspection of the mucous membrane suffices to determine whether part of the secretion comes from the vagina, but in doubtful cases the uterine cavity must be shut off with a tampon. In colpitis the tampon will be found more or less saturated with fluid, and the surface presenting toward the vagina covered with pus. In macular colpitis the tampon is covered with yellowish dots, each corresponding to a patch on the vagina.

Differential Diagnosis. The differential diagnosis between colpitis and simple hypersecretion may be difficult. The latter is found in pregnancy, with inflammations, exudates, and tumors in the neighborhood of the vagina, in chlorosis and other forms of anemia, after excessive irritation by coitus, and masturbation. The presence of pus, or severe hyperemia of the mucous membrane, always renders inflammatory changes of the mucous membrane more probable.

Differentia Diagnosis from Hypersecretion.

Thrush of the vaginal mucous membrane produces a picture similar to that of colpitis with desquamation of epithelium. The disease occurs most frequently in pregnancy and also leads to the production of whitish patches on the mucosa. The patches, however, are not very extensive and usually occupy the top of the folds; they are not so readily wiped off, and stick fast in the uppermost layers of epithelium, hence their forcible removal is followed by hemorrhage. Examination of the white patches in diluted caustic potash shows large quantities of epithelial cells only in the case of colpitis, and the mycelium of oidium albicans if thrush is present.

In rare cases part of the mucous membrane sloughs off in colpitis and is discharged in large coherent shreds. This frequently occurs after cauterization with iodin. It is practically impossible to mistake such membranes for uterine products because they represent merely a layer of squamous epithelial cells and not a complete mucous membrane; under the microscope, the large cells with their central nuclei are easily recognized.

Vulvitis.

Catarrhal vulvitis is an inflammatory disease of the mucous membrane of the inner surface of the labia majora, the labia minora, clitoris, and vestibule, as far as the hymen. It is frequently combined with inflammations of the mucous canals that open into the vestibule, *i.e.*, the urethra, the ducts of Bartholin's glands, and Skene's ducts. The diagnosis is based almost exclusively on the

Catarrhal Vulvitis.

changes in the mucous membrane, which are easily recognized by inspection. In recent, and particularly in infectious cases, the mucous membrane is diffusely reddened, pale, or bright scarlet in color, especially at the introitus; in chronic cases it is paler, but marked with red patches and stripes at the border of the hymen, immediately around the urethral orifice, on the outer surface of the hymen, and at the excretory duct of Bartholin's glands. The mucous membrane bleeds when roughly handled (as during the introduction of a speculum), especially at the above-mentioned hyperemic places; touching the inflamed parts too frequently elicits contractions of the constrictor cunni and the muscles of the pelvic floor. In acute cases the greater and lesser labia are swollen.

The discharge in acute cases is purulent and mixed with the viscid, tenacious mucus of Bartholin's glands. In vulvitis maculosa there is no secretion whatever, and the mucous membrane is covered with shreds consisting of desquamated squamous epithelium; on the other hand, milky or purulent secretion can sometimes be expressed from the small recesses in the membrane.

Vulvitis pruriginosa or **pruritus vulvæ** is a chronic inflammation of the vulvar mucous membrane, with intense itching as the most prominent symptom. In recent cases the mucous membrane shows no alteration, but in protracted conditions the mucous membrane, as well as the surrounding skin, as a result of the scratching and rubbing, appears relaxed, withered, and puckered, especially around the prepuce and clitoris, and the color is a bluish-gray; here and there scratch marks are seen. The pruritus is secondary, due to the constant irritation of abnormal secretions which accompany various conditions, such as endometritis, carcinoma, menstruation; or of urine containing abnormal constituents, as in diabetes mellitus, nephritis, icterus; or the irritation of parasites; in rare cases the cause is a venous hyperemia accompanying tumors or a cardiac lesion. Hence the most important part of the diagnosis consists in discovering the cause of the itching, because its removal is also the most important therapeutic indication. The most frequent causes are endometritic secretions and diabetes. The urine should always be examined for sugar in well marked cases of vulvitis. It is quite common for diabetes to be discovered first in the gynecologist's office.

Craurosis vulvæ is an atrophic condition affecting the corium of the mucous membrane covering the labia majora and minora and the introitus. The greater labia appear flat, while the labia minora may be entirely wanting, or merely suggested by two flat longitudinal ridges; the clitoris is small and usually completely hidden underneath the folds of the atrophic mucous membrane; the

Craurosis Vulvæ.

introitus is contracted; the mucous membrane is whitish, with gray spots, and atrophic. The difference between craurosis vulvæ and pruritus vulvæ consists in the contraction of the introitus and the atrophic condition of the skin in the former, as compared with the relaxation observed in the latter.

Diagnosis of the Extension of the Catarrh.

Catarrhal disease of each segment is definitely limited by its own physical signs and symptoms. Frequently, however, the physical signs, either the secretions or the changes in the mucous membrane, are mixed because several segments are attacked at the same time, or because the catarrh spreads secondarily to neighboring organs; hence it becomes the physician's duty to determine the extent and extension of the catarrh in the genitalia. From the standpoint of treatment it is particularly important to ascertain whether the uterus as well as the vagina, or the body as well as the cervix, is diseased; the treatment must, if possible, include the highest portions affected; otherwise they will constantly reinfect the lower segments after the catarrhal process has been arrested in the latter. For practical purposes it is always best to examine from below upward. If a patient consults her physician for leucorrhea, the first point to ascertain is the quantity of the discharge, as shown by the appearance of the clothing and the external genitalia. At the same time the effects of the irritating secretions are noted in the vulva and on the inner aspect of the thighs in the form of redness, eczema, and cutaneous ulcers. Next, the vulva is inspected and if the findings are positive, and particularly if the inflammation is acute, the urethra, the glands of Bartholin and the small mucous canals are included in the examination. In cases of gonorrheal catarrh the presence or absence of infection of the rectum must be determined by inquiring about the discharge of pus and rectal symptoms, as well as by inspection with a rectal speculum. The next step is the introduction of the speculum for the purpose of examining the vagina, the outer surface of the vaginal portion, and the cervical mucous membrane as far as it can be seen. It is extremely important to determine whether the catarrh is limited to the vagina or involves the uterus also. If on repeated examination the vagina is found to contain only a white, milky, serous, or granular secretion, disease of the uterus may be excluded; if mucus is found in the vagina, it is a positive sign of cervical involvement. If, on the other hand, the secretion in the vagina is purulent, either pure pus or seropurulent, it may be derived from the vagina, or may have escaped from the uterine body. The first point is easily determined by inspecting the vaginal mucous membrane, and by noting whether abnormal secretion escapes from the external os it can be deter-

mined whether some of the discharge is produced in the uterus. A still better method of deciding the question, however, is the application of the Schultze tampon, which must always be employed if the vagina is found to contain pus. As a rule it is quite easy by this means to decide whether the uterus is diseased in addition to the vagina; on the other hand, it is much more difficult to make out whether the uterine body alone, or both together, are concerned in the catarrhal processes. In typical cases it is easy to recognize whether the secretion on the tampon is purulent or seropurulent (corporeal catarrh), or simply mucous (cervical catarrh); but in most cases the secretion is a mixture of pus and mucus, and its origin is difficult to determine (see page 505). Hence the tampon sometimes fails to yield the important information whether the catarrh has involved the uterine body or has not extended beyond the internal os. In doubtful cases of this kind the following symptoms are in favor of corporeal disease: Severe dysmenorrhea or intense menstrual pain, as described above, point to endometritis. Severe menorrhagia in cases of recent, and particularly purulent cervical catarrh, cannot always be regarded as a sign that the catarrh has extended to the body, as it may be merely the expression of a concomitant hyperemia of the uterus. In the latter case it ceases with the acute stage. If, however, the menorrhagia persists for some time into the chronic stage, there is strong reason to suspect that the body also is involved. If tubal disease is found associated with cervical catarrh, it is a positive sign that the infection has passed through the body, but not necessarily that it has produced a permanent change in the mucous membrane. Sounding cannot be employed for the diagnosis of corporeal disease in most cases, because it is too dangerous.

Diagnosis of Gonorrhea.

After the seat and extent of the catarrh in the genital organs and adjoining regions have been determined, the next question to decide is whether the process is gonorrheal. Although certain other causes are not without importance, particularly as regards prophylaxis and treatment, the demonstration of gonorrhea is by far the most important point on account of the frequency of the disease, the danger of its spreading upward, the fact that it is contagious, and the radical differences in the treatment of this infectious disease.

The diagnosis of gonorrhea may be made by demonstrating the presence of gonococci and the specific changes which they produce in the affected membranes.

The **presence of gonococci** is positive proof that the infection is gonorrheal and is not approached in importance by any clinical sign; but the biologic peculiarities of the gonococcus, and the peculiar condi-

tions existing in the mucous membrane of the female genital organs, greatly impair the value of bacterioscopic diagnosis. In the first place, the gonococcus can be satisfactorily demonstrated only in those portions of the mucous membrane in which it is present alone, or associated with a few other microörganisms. It is found most easily in the urethral secretion, in the vulvovaginitis of children, and in the cervical secretion of nulliparous women; while it is much more difficult to demonstrate in the cervical secretion of multiparæ with patulous external os, and can very rarely be found in the vaginal secretion of adult individuals. Another limitation of the value of bacterioscopic diagnosis is the rapid destruction and elimination of the gonococci in the affected tissue. Their numbers begin to diminish considerably after a short time, and those that remain may occupy the deeper layers of the epithelium or hide themselves in the recesses and folds of the cervical mucous membrane, so that they can no longer be demonstrated. But whenever the conditions are favorable, as during menstruation or the puerperium, or after severe mechanical irritation of the affected mucous membrane, the gonococci may suddenly begin to multiply again. Hence the failure to find gonococci in no sense excludes the presence of gonorrhea. Unless repeated examination after menstruation or during the puerperium, or after mechanical or chemical provocation, has failed to reveal the presence of gonococci, the diagnosis of gonorrhea must still be considered; hence an attempt should always be made to demonstrate the microörganisms, if great importance attaches to the diagnosis. In medicolegal cases, and for the purpose of determining whether the secretions are capable of causing infection, a bacteriologic examination is indispensable.

The urethral secretion is obtained by slowly passing the index finger along the canal from behind forward through the vagina, and exerting gentle pressure, several hours after the last urination. The cervical secretion is obtained directly with a loop from the cervical canal. (For the method of demonstrating the presence of gonococci see page 64.)

The **clinical diagnosis of gonorrhea** is based on the presence of changes in the tissues that have been produced by the gonococci. These changes are not pathognomonic as they may also be produced by other microörganisms or irritants. Depending on the preponderance of the gonorrheal etiology in these tissue changes, they may be divided into positive, probable, and uncertain signs of gonorrhea.

I. Positive signs of gonorrhea are tissue changes produced exclusively, or at least almost exclusively, by gonococci.

(a) Recent purulent urethritis. Infection with other microörganisms, such as bacterium coli, is extremely rare.

(b) Purulent processes in Bartholin's glands. These include recent adenitis in which pus can be expressed from the excretory duct; recent painful swelling of the gland due to occlusion of the duct and retention of pus; and abscesses of Bartholin's glands (suppuration of Bartholin's glands due to other microörganisms are so rare that they may be disregarded).

II. Probable signs are tissue changes which may be produced by other microörganisms or irritants, but are much more frequently gonorrheal in nature. These include

1. Old urethritis with moderately abundant, milky discharge and possibly periurethral infiltration.

2. Small, hard, non-sensitive swelling of Bartholin's glands; cysts of Bartholin's glands; redness and a flea-bitten appearance of the mucous membrane surrounding the excretory duct (macula gonorrhœica).

3. Condylomata acuminata.

4. Acute colpitis with profuse purulent secretion and marked swelling of the folds and papillæ.

5. Acute cervical catarrh, in which the secretion is chiefly purulent.

6. Pyosalpinx. It has never been definitely determined that this may be due to some other infection, such as tuberculosis.

III. Uncertain signs are tissue changes which may be due to gonorrhea as well as to some other cause. They include

1. Slight milky secretion from the urethra and Skene's ducts.

2. Redness appearing in patches at the top of the folds and caruncles of the urethra, in the neighborhood of the urethra, and around Skene's ducts.

3. Colpitis maculosa (see page 517).

4. Cervical catarrh with mucopurulent discharge.

5. Suppurative endometritis.

6. Hydrosalpinx.

7. Adnexal tumors (see page 461).

8. Perisalpingitis and perioöphoritis.

The importance of the bacterioscopic diagnosis is inversely proportionate to the value of the clinical signs. If positive signs are present, it is absolutely unnecessary and can do no more than confirm the clinical diagnosis. In the presence of probable signs it is a very welcome confirmation of the diagnosis. When the signs are uncertain, a positive diagnosis is impossible without it. Unfortunately, however, bacterioscopic diagnosis very often fails, even in cases which only present probable signs; and when the signs are uncertain and it is most needed, it almost always proves negative. We may say, therefore, that bacterio-

scopic diagnosis is usually unnecessary when it is successful, and in cases in which it would be necessary the results are rarely positive. Nevertheless, the method should be employed even for purposes of diagnosis alone.

The only fact in the history that has any positive value is the occurrence of gonorrheal ophthalmia in one of the patient's children. The statement that the disease began with acute symptoms in the vulva and urethra immediately after coitus or after marriage, is strong presumptive evidence that the infection is gonorrheal, as is also the discovery of a recent gonorrhea in the husband. The fact that the patient has had a previous attack of gonorrhea is less significant.

Microscopic Diagnosis of Endometritis.

Necessity of Examining the Scrapings.

Without an accurate knowledge of the changes that occur in the inflamed endometrium, the microscopic diagnosis of material obtained by curettage is impossible. The inexperienced may mistake a benign alteration for a malignant, and *vice versa*, and the treatment may accordingly prove disastrous to the patient. An injustice may be done to the patient by giving an incorrect prognosis, and the physician's reputation may suffer. Microscopic examination of scrapings should never be neglected, because the physician may mistake a benign condition for malignant changes, or *vice versa*, on the strength of his clinical examination. In many cases a positive diagnosis is impossible without microscopic examination. Endometritis of the uterine body, being the most important and most frequent form, will be treated first, and next in order cervical endometritis.

FIG 303.—SCHEME: (*a*) Cross-section of five normal uterine glands. (*b*) As the result of cellular multiplication of the stroma the glands are forced apart and compressed.

Corporeal Endometritis.

The diagnosis of **corporeal endometritis** requires a knowledge of the composition of the normal endometrium, particularly, (**a**) the epithelium and its structures; and (**b**) the stroma. Both constituents may share in the inflammatory disease, either separately or together, or one more than the other. Inflammation of the epithelium and its structures (uterine glands—glandular endometritis), and inflammation of the stroma (interstitial endometritis), have this in common, that they depend in the main on a cellular multiplication.

(**A**). In the acute or usual form of **interstitial endometritis** (e. interglandularis) a considerable cellular multiplication often takes place. The number of stroma cells in the intervals between the glands may be increased to twice, three times, or ten times the normal. As a result of this the glands are forced apart, and compressed by the proliferation in the stroma, which completely surrounds them. The changes

are most easily seen in cross-sections (Fig. 303). The acute cellular multiplication causes a thickening of the entire mucous membrane.

In acute interstitial endometritis the increased stroma cells are seen in the microscopic picture as round elements completely filled by their nuclei so that no cell body can be seen, and closely packed. The glands, as compared with the normal (Fig. 303, *b*), appear compressed and forced apart. In the more chronic types of interstitial endometritis, or after several relapses, the accumulation of small round cells is replaced by the appearance of numerous spindle-shaped elements, giving the effect of cicatricial or fibrous tissue, or cirrhosis. In chronic interstitial endometritis the uniform arrangement seen in the acute process becomes irregular—strands of connective tissue alternating with round-celled infiltration (Fig. 305). In the exudative forms an albuminous fluid is found among the circular stroma cells, which becomes coagulated by the preliminary treatment of the microscopic specimen and presents a finely granular appearance (Fig. 306). In extreme cases of exudative endometritis the stroma cells appear wide apart, and the individual elements somewhat compressed and diminished in size. As the exudate does not take the stain, a striking difference is seen in the microscopic picture between interstitial endometritis with its abundance of cells, and the exudative form; the former is dark red when alum-carmine is used, while the latter appears pale and translucent.

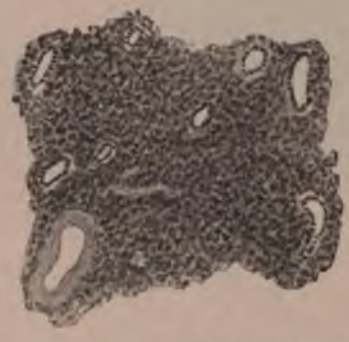


FIG. 304.—ACUTE INTERSTITIAL ENDOMETRITIS. The proliferated stroma cells are closely packed; the glands appear diminished in number.

FIG. 305.—CHRONIC INTERSTITIAL ENDOMETRITIS.

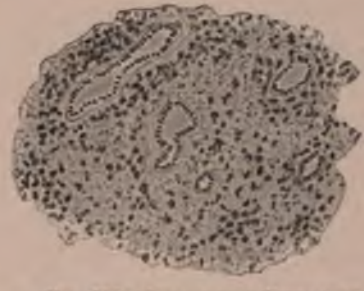


FIG. 306.—INTERSTITIAL EXUDATIVE ENDOMETRITIS. A finely granular exudate forces the stroma cells apart.

In exudative endometritis the cells of the stroma are sometimes rendered even more prominent by the presence of the exudate; spindle-shaped and stellate elements with numerous processes are seen connected together, producing a fine meshwork. The exudative forms are

usually encountered with dysmenorrheic affections, the most typical picture being seen in the dysmenorrheic membranes. The connective tissue structure of the stroma formed by the processes of the stroma cells (see under normal histology) may appear greatly thickened and fibrous; although in the main the same inflammatory process always produces the same microscopic pictures in the endometrium, the interstitial cellular character may be more prominent in some cases than the exudative, and *vice versa.*

Combination of Various Forms.

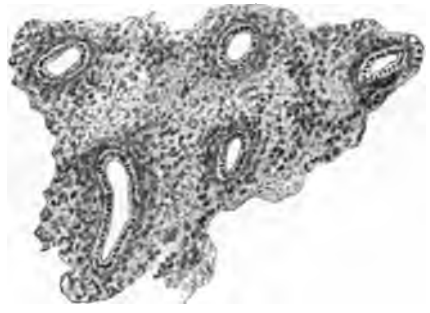
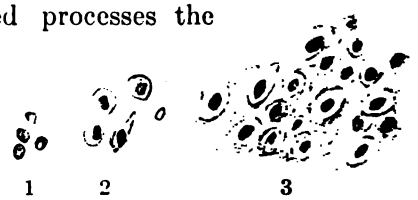


FIG. 307.—COMBINATION of pronounced interstitial, periglandular endometritis, with exudative endometritis.

In this connection so-called periglandular interstitial endometritis (comp. Fig. 307 and Fig. 264, *a*) is interesting. The interstitial tissue forms a marked cellular accumulation only in the parts immediately surrounding the glands, while the more remote portions look more like exudative endometritis. If carcinomatous degeneration develops in the cellular layers surrounding the glands, which occasionally happens, a periglandular sarcoma is produced (comp. Fig. 264, *b*). In the microscopic section exudative endometritis often appears in patches, on account of the irregular alternation of cellular accumulation with exudate.

In addition to the increase in the stroma elements and the exudate observed in the exudative form, the inflammatory process in interstitial endometritis produces a change in the shape of the stroma cells. Even in inflamed processes the stroma cell is a small round cell entirely filled with its nucleus, so that no part of the cell body is seen. The nucleus stains intensely. Occasionally in severe inflammatory conditions, and particularly in exudative processes (also when the glands in the mucous membrane perforate), the stroma cell becomes larger, the cell body more distinct, the nucleus slightly oval and not so intensely tingible, and often finely granular.



1 2 3

FIG. 308.—DIAGRAMMATIC: 1. Normal stroma cell. 2. A cell from the lowest layer of a dysmenorrheic membrane. 3. Conversion of stroma cell into an element resembling the decidual cell.

The Stroma Cells Resemble Decidual Cells

This conversion of the stroma cell into an element with a distinct cell body is also found in glandular endometritis, and often in the hypertrophied mucous membrane which is seen with myomata. The changes are most distinct in the superficial layers of the mucous membrane and, owing to their spindle shape, the cells often resemble decidual cells.

Similar changes are encountered in dysmenorrheic membranes, whereas in ordinary preparations interstitial endometritis with its small round cells is found in the upper layers, the deep portions of the mucous membrane, where laceration has taken place, present small round oval elements with distinct cell body and circular nucleus. The cell body does not stain well. In rare cases the enlargement of the stroma cells is so great that the alteration cannot, at the first glance, be distinguished from that of pregnancy (endometritis interstitialis deciduacellularis, Fig. 309). It may be exceedingly difficult to make a positive microscopic diagnosis in such a case. (See differential diagnosis under changes of pregnancy.) The fact that the elements are not always quite regular sometimes makes the diagnosis of the non-gravid alteration somewhat easier.

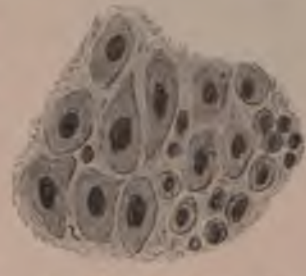
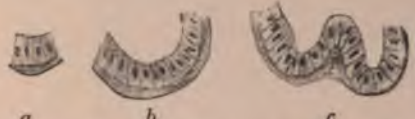


Fig. 309.—The Stroma Cells in Dysmenorrheic Membranes occasionally show a decidual change.

Exudative interstitial endometritis more often than any other form leads to atrophy of the mucous membrane, instead of ending in recovery or going on to the chronic form. The mucous membrane becomes exceedingly thin, and the glandular structures, as a result of the atrophy, are displaced in some places, and in others reflected on themselves, producing the picture of premature senility. Curettage, which may have been performed on account of distinct clinical symptoms for the special purpose of making a diagnosis in cases of this kind, yields a very small quantity of material for examination.

Senescentia Præcox.



a *b* *c*

Fig. 310.—Multiplication of the Glandular Epithelium (*a*), leads to an increase in the size of the fundus (*b*), or to an increase in the curvature (*c*).

(B). In **glandular endometritis** a numerical increase in the epithelial cells, either those which cover the surface of the uterine mucous membrane or those which form the uterine glands within the membrane, takes place. The effect of this epithelial multiplication will be appreciated by studying the normal processes of epithelial proliferation. A number of epithelial cells (cylindrical cells, Fig. 310, *a*), since multiplication always takes place horizontally, cannot retain the same base, as, in order to accommodate the increased number of cells, even if the latter are somewhat narrower than the original normal cells, the base must become larger and longer (Fig. 310, *b*). As the multiplication increases, a still larger base or foundation is required for the cells, which is effected by increasing the curvature

The Epithelial Multiplication in Glandular Endometritis Produces a Papillary Change in the Surface.

of the base (Fig. 310, *c*).—At the surface of the endometrium the epithelial multiplication produces slight elevations and depressions which are, of course, accompanied by corresponding elevations of the mucous tissue—the surface becomes slightly papillary.—In the uterine glands the epithelial multiplication takes place in all directions, and thus produces two different effects—the gland becomes elongated and the cross-section distinctly enlarged (Fig. 312).—Macroscopically the epithelial proliferation produces an increase in the thickness of the mucous membrane; while in the microscopic picture, aside from the elongation, the increase in the width of the glandular lumen reduces the intervals between the glands (Fig. 312, *c*). If the curvature of the fundus is increased by the cellular multiplication, tortuosity is added to the elongation and widening of the glands. In the microscopic picture the tortuosity appears exceedingly uniform; the glands, which are in the main parallel, retain their relative directions even after cellular multiplication has rendered them tortuous (Fig. 313). In addition to simple tortuosity in the direction of a pendulum, so to speak, *i.e.*, in one plane, a spiral, or, as it is usually called, "corkscrew" figure, may be produced. The glands thereby appear to approach one another and the lumen also becomes wider as a result of the cellular multiplication. In the microscopic picture the glands may retain their parallel course for a long distance. Corkscrew glands are obviously not seen in the section in their entire length, since they do not occupy the same plane. When the epithelial proliferation is very great, the sinuosities of the glands are correspondingly greater and more numerous in a given

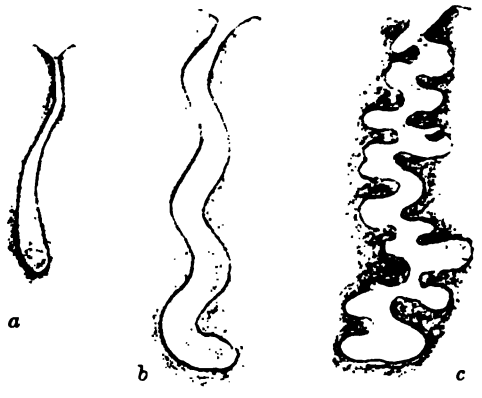


FIG. 311.—THE CELLULAR MULTIPLICATION leads to elongation and widening (*b*) of the normal glands (*a*) as well as to tortuosity (*b*, *c*).

Glandular Endometritis with Tortuosity.

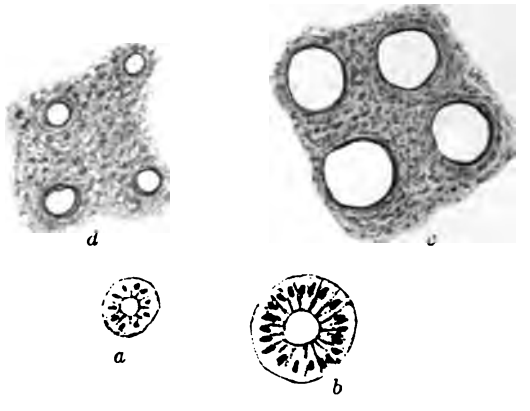


FIG. 312.—DIAGRAMMATIC: As a result of cellular multiplication the uterine gland (*a*) becomes wider and larger (*b*); the intervals between the glands apparently become smaller (*c*) as compared with the normal (*d*).

section of the structure. The tortuosity merges into the appearance of papillæ, and the epithelial layers appear papillary; in longitudinal section, owing to the projections, they suggest the teeth of a saw (Fig. 314), while in transverse sections the picture is stellate or indented.

All these changes are observed in glandular endometritis—elongation, dilatation, and tortuosity and saw-tooth formation. The two first usually affect the entire thickness of the mucous membrane uniformly, while in the saw-tooth formation the epithelial proliferation and the resulting papillary structure is seen only in the deeper portions of the gland, the upper portion remaining unchanged, rather thinner than normal, as though drawn out (Fig. 314, *a*). The deeper portions of the mucous membrane often appear spongy (endometritis glandularis profunda). Of course tortuosity as well as the dilatation may also occur in the latter form.

FIG. 313.—THE PROLIFERATION OF THE GLANDULAR EPITHELIUM produces tortuosity of the glands; longitudinal section (*a*), cross-section (*b*).

Glandular endometritis, which we have just described, like every other form of endometritis, consists in a cellular multiplication which leads to dilatation, elongation, tortuosity, or the saw-tooth formation of the gland, and, since the change chiefly affects the gland itself, is called a hypertrophy; or in other words, endometritis glandularis hypertrophica.

FIG. 314.—PROLIFERATION OF THE GLANDULAR EPITHELIUM produces a saw-like appearance; (*a*) longitudinal section; (*b*) cross-section.

In addition to the hypertrophy or enlargement of the glandular apparatus, we also have hyperplasia, or an increase in the number of the glands. Hyperplasia rarely occurs without hypertrophy, although the latter may be present without the former. Hyperplasia is due to the same processes as hypertrophy, namely, cellular multiplication; but in this case the gland tubes increase either by an actual increase in the glands, or by division of the glands, or by

an extension of the glands beyond their normal site into the adjoining tissue (muscularis) (Fig. 315_3). In genuine multiplication of glands the surface epithelium grows into the tissue (Fig. 315_1) and forms new glands. This process of hyperplasia is to be observed chiefly in polypoid proliferation. The increase in the number of gland tubes is effected by evaginations of the gland tubes, by eversions along the course of the glandular shaft (Fig. 315_2), and these eversions may give origin to secondary eversions (secondary division). At first the eversions or evaginations are smaller than the original gland, and in sections obtained at the beginning of the process the groups of smaller gland openings are found near the inner lumina; in the place of one, we see many cross-sections of glands (Fig. 316). A third form of hyperplasia is produced by the glands' encroaching on the muscularis. The uterine glands, which in normal tissue usually cease abruptly at the edge of the muscularis, push their way in between the muscle bundles in the form of thin mucous glands, and this occurs even when the deepest portions of the mucous membrane are the seat of marked papillary (saw-tooth) proliferation. The uterine glands may extend from one to two centimeters, or even farther into the muscularis. The glands are seen in groups in various portions of the section.

FIG. 315.—THE PROLIFERATION OF THE GLANDULAR EPITHELIUM LEADS TO HYPERPLASIA: 1. The glands proliferate into the mucous membrane. 2. Diffuse ramification of the glands. 3. They penetrate into the muscularis.

FIG. 316.—ENDOMETRITIS GLANDULARIS HYPERPLASTICA. The glands that undergo division at first present small division-glands.

In order to recognize the inflammatory processes it is very important to have the ability to distinguish between hypertrophic and hyperplastic conditions, although hypertrophy cannot always be sharply separated from hyperplasia. Most cases present sufficient differences to enable one to apply the two terms correctly to the two different forms of cell multiplication.

Uncomplicated forms of glandular endometritis, whether hypertrophic or hyperplastic, and pure forms of interstitial endometritis are rarely seen. The two are usually associated; either the epithelial and connective tissue portions of the uterine mucosa are attacked together, or a glandular endometritis is superadded to an interstitial, or *vice versa*. The mucous membrane also appears thickened to the naked eye, even more so than in uncomplicated forms. Microscopically the intervals between the dilated glands are larger in the combined form than in pure glandular endometritis (Fig. 317, *b* and *c*). In a case of interstitial endometritis it may be assumed that the glandular apparatus is involved in the inflammatory processes if the glands are both forced apart and greatly dilated, or if tortuosity or saw-tooth formation is present. The term 'endometritis interstitialis glandularis' is then employed.

Combinations of Various Forms of Endometritis.

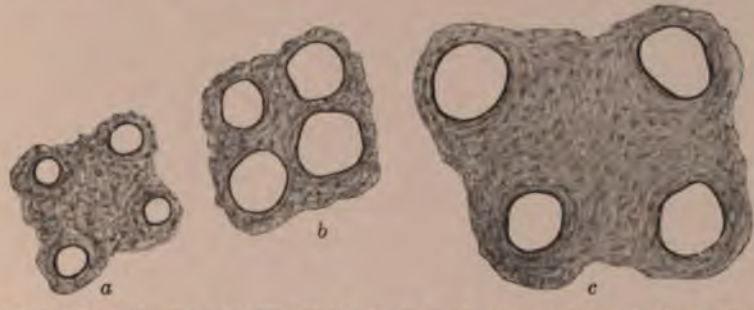


FIG. 317.—COMBINATION OF GLANDULAR AND INTERSTITIAL ENDOMETRITIS. In simple glandular endometritis (*b*) the glands seem to be closer together than in normal tissue (*a*); when it is combined with interstitial endometritis, the glands are forced apart (*c*).

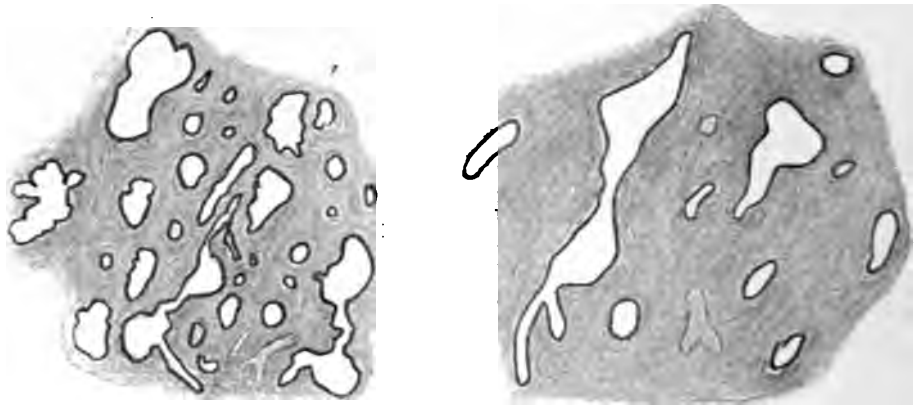
Another combination may be produced by the development of the exudative form—endometritis interstitialis glandularis exudativa. In the combined, as well as in the simple forms of endometritis the process may be found either in the superficial, or in the deeper portions of the mucous membrane. In glandular endometritis the deeper layers often appear more glandular, while the superficial present more interstitial changes—a condition which might be termed endometritis glandularis profunda interstitialis superficialis. Above, the mucous membrane appears compact; while the deeper portions appear to be of a spongy nature, producing a similarity to decidua vera in the first month. Endometritis with a glandular change above, and an interstitial change below, has probably never been observed.

Various Combinations of Interstitial, Glandular, Exudative, Deep, and Superficial Processes.

In the combined forms of endometritis also the entire mucous membrane in the main falls a victim to the inflammatory process, and the microscopic pictures are, generally speaking, the same everywhere.

So far we have spoken only of acute or subacute inflammatory processes. Complete recovery may take place, with complete regeneration, although usually more or less irregularity remains both in the glands and in the interstitial portion. Dilatations may persist in the glands, and cellular increase may be arrested in the interstitial tissue. It is needless to say that relapses produce even greater and more extensive changes on the already impaired soil than were produced by the first acute inflammatory processes. The interstitial tissue in relapses shows more fibrous material and more spindle-shaped elements, giving the picture the character of chronic inflammation. This must be regarded as the result of incomplete regeneration and constitutes cicatricial contraction.

Relapses of Inflammatory Processes.



a *b*

FIG. 318.—(*a*) ENDOMETRITIS GLANDULARIS INTERSTITIALIS ECTATICA (*chronica*). (*b*) ENDOMETRITIS INTERSTITIALIS GLANDULARIS ECTATICA. In the latter the interstitial and in the former the glandular portion is chiefly involved (fungous endometritis).

In chronic inflammatory processes, spindle-shaped, fibrous and cicatricial masses are produced in the stroma, causing cicatricial contraction, kinking and constriction of the glands in the connective tissue portions of the mucous membrane. This leads to saccular dilatations containing mucus and fluid—ectasiae, or to absolute constriction—cysts. The dilatations encroach on the neighboring tissue, producing another alteration known as endometritis glandularis ectatica cystica interstitialis chronica (Fig. 318). If the irritation continues, and renewed cellular proliferation takes place, the cysts and dilatations may send out additional gland tubes by eversion, producing a structure with enormous rootlets (Fig. 319). The shaft of the gland may be covered by a whole series of ectasiæ.

Chronic Inflammatory Processes Produce Ectasiæ and Cysts.

Macroscopically the mucous membrane may become greatly thickened, from one-half to one, or even one and one-half centimeters,

projecting from the cut surface like a mushroom, and producing the picture of fungous endometritis. The glandular dilatation may reveal itself to the naked eye by the spongy (actually sponge-like), cribriform appearance of the mucous membrane. The presence of ectasiæ and cysts in the microscopic picture may decide whether the process is acute or chronic, as both changes are in favor of chronic or relapsing processes.

Fungous Endometritis.

Fig. 319.—Endometritis Ectatica Chronica. The dilated glands give off fresh proliferations—"root sprouts."

In acute, as well as in chronic glandular endometritis, as in the case of the interstitial form, regeneration may lead to atrophy of the mucous membrane, which is converted into a thin, cicatricial layer of connective tissue containing a few remains of glands. The latter are narrow, irregular in shape, and often in process of disintegration (endometritis atrophicans). It is practically indistinguishable from the senile or atrophic endometrium, and is very probably due to a precocious senility which has its beginning in the middle of the fourth decade of life.

Another peculiar change occasionally seen in glandular endometritis is an apparent stratification of the epithelium, although the epithelial layer retains its regularity and is arranged in two uniform layers. On careful inspection this arrangement in two layers is explained by the peculiar grouping of the cells; one with a broad base and narrow upper extremity is found next to a cell with a narrow base and broad head-piece. In the elements with broad bases the nuclei are more basally situated. This formation is the result of an attempt on the part of the cells to equalize one another as they increase (Fig. 320). In rare cases two layers of cells are actually present. Another change concerns the tingibility of the elements. While the nucleus still stains fairly well, the cell body is often quite pale, and a certain similarity to cervical epithelium is thus produced. A very interesting epithelial change, which is often observed in the saw-tooth formation, closely resembles the Opitz-Gebhard glands of pregnancy. The cylindrical epithelium becomes more round and piles up in several layers on the papillary ledges, becoming almost like squamous epithelium. The cells are grouped in bunches and their

Fig. 320.—Apparent Stratification (in Two Layers) of the Epithelium, produced by the mutual adaptation of the elements which accompanies marked proliferation.

Change in the Tingibility.

connections are loosened. Often the picture of desquamation is seen. The tingibility of the cells is diminished. It appears as if a metaplasia of the cylindrical epithelium took place, and the stratification may even arouse a suspicion of beginning carcinoma.

The same picture is produced by the irritation of pregnancy, and this glandular change is therefore somewhat characteristic of pregnancy, but is in no sense pathognomonic (see Fig. 258). Similar changes in the glands—stratification, conversion of cylindrical into squamous epithelium (metaplasia)—may occur in simple inflammatory processes also. Large portions of the gland wall, however, may retain their cylindrical epithelium; the tunica propria is lost (comp. Fig. 259), suggesting the possibility of carcinomatous change. It is probable that the alteration is due to a necrobiotic process, characterized chiefly by enlargement, or by a peculiar swelling, of the glandular epithelium. An epithelial change which is found in large cysts, and in which the epithelium becomes shortened, cuboidal, or even like squamous epithelium, must be ascribed to mutual pressure and dilatation.

Necrobiotic Processes in the Glands Leading to Atrophy.

It is exceedingly important to become familiar with these epithelial changes in order to avoid making an erroneous diagnosis of pregnancy or carcinoma.

The changes that take place in the arteries and veins, so far as they may be judged by the microscopic picture, vary greatly. In many cases it seems as if the blood-vessels took no part in the process whatever. The most marked inflammatory proliferations do not show a corresponding increase in the blood-vessels; on the other hand, some preparations distinctly show dilatation of the vessels, and the thickness of the vessel wall may indicate the extent to which the arteries take part in the inflammation. They present a cirsoid, grapevine arrangement in the mucous membrane, the reflections of the vessels and the many adjacent transverse sections of the same vessels producing a pretty picture in the microscopic section. In hemorrhagic endometritis numerous extravasations of blood in the superficial layers are seen in addition to the dilatation of the vessels, like small apoplexies with bloody infiltration—pictures like those seen in menstruation, or even small subepithelial hematoma.

Changes in the Vessels.

Hemorrhagic Endometritis.

The involvement of the lymph vessels is difficult to determine in microscopic preparations. In mild cases dilatation of the lymph vessels or clefts may be seen, but nothing of the kind appears in more severe cases. Occasionally in malignant cases the lymph vessels are thrombosed with a cleft-like arrangement, hanging together like a meshwork, and filled with small cells.

Changes in the Lymph Vessels.

With regard to nomenclature, the designation should be such as to suggest at once to the hearer the corresponding macroscopic and microscopic picture. We speak of an interstitial and glandular endometritis. When the two conditions are combined, the term endometritis interstitialis glandularis is appropriate, if the interstitial changes predominate; or endometritis glandularis interstitialis, if the glandular changes are more prominent. Next we have, for special conditions, exudative, or even hemorrhagic, interstitial or glandular endometritis. Endometritis glandularis ectatica, cystica, hypertrophica or hyperplastica need no further explanation. Finally, the duration of the process is indicated by the adjectives acute, chronic, or subacute.

When it is impossible to determine whether the interstitial or the glandular hypertrophy predominates, the term diffuse endometritis may be employed.

In practice an accurate and descriptive scientific microscopic diagnosis is not as important as it is for the proper recognition of the condition. The point to determine is whether the disease is benign or malignant, whether treatment is necessary, and if so, what therapeutic measures are indicated. It should not be forgotten, however, that in benign changes the prognosis with regard to the possibility of recurrence can be determined by the microscopic picture. Certain glandular ectatic hyperplastic forms of endometritis are exceedingly prone to recur in a very short time. If there is a marked tendency to repeated hemorrhage, total extirpation may be considered and may indeed be absolutely necessary, even when the microscope shows that the changes in the mucous membrane are benign. It is more particularly in cases of benign but marked recurrences, which in themselves are an indication for extirpation of the organ, that a microscopic examination is very desirable, so that at least a definite prognosis may be given after the operation. In simple endometritis an absolutely favorable prognosis may be given after total extirpation, while after a radical operation performed on account of malignant degeneration the prognosis is always somewhat doubtful on account of the possibility of malignant metastases. Inspection alone, to determine the quantity of the scrapings obtained, can never decide the diagnosis, furnishes uncertain therapeutic indications and is of doubtful value in making the prognosis.

In addition to the above-mentioned designations, a few others are in use which are permissible only within certain limits. In so-called endometritis fungosa—a most descriptive term for the microscopic appearance of the mucous membrane—the hypertrophied mucous membrane, one centimeter thick or more, projects from the cut surface of the organ like a mushroom; whole handfuls of material are often obtained by curettage. While the word "fungus" is macroscopically descriptive, a microscopic examination is necessary to determine whether the condition is malignant; conversely, an apparently fungous endometritis may seem to be clinically malignant and later may be shown to be benign by the microscope. After macroscopic examination an endometritis may be called 'fungous,' for the sake of brevity. It should, however, be further characterized by the terms 'glandular interstitial,' or 'hyperplastic,' 'ectatic,' 'cystic,' 'hemorrhagic,' or 'exudative interstitial glandular,' as the case may be.

Fungous Endometritis.

The adjective 'chronic' is not necessary if ectatic has been used, as multiple ectasiæ in themselves indicate that the process has existed for some time.

The term 'adenoma' has often been used instead of glandular endometritis; but we are very apt to associate the notion of malignancy, or at least of something suspicious, with adenoma; hence the designation benign adenoma—in contradistinction to malignant adenoma—was introduced. Again the suffix 'oma' usually indicates some form of tumor. Some authors use adenoma only for polypoid proliferations and polyps. The term 'benign adenoma' has not met with approval.

Benign Adenoma of the Body.

A knowledge of the changes that are produced in the uterine mucous membrane as a whole is even more important for the microscopic diagnosis, which must be made by scrapings from the uterine cavity. The picture of the uterine mucous membrane as a whole has to be constructed from a small particle. In the scrapings particles obtained from the surface alternate with material removed from the deeper layers, and the microscopic picture contains horizontal and oblique, as well as transverse sections. A large number of sections must be prepared in order to make sure, for example, that all the particles are free from malignant change. If a preparation derived from the deeper layers of the mucous membrane is markedly glandular, while another from the same lot of scrapings is markedly interstitial, the diagnosis of endometritis glandularis profunda interstitialis superficialis, which is so common with myomata, will be made.

Diagnosis of the Mucosa *in Situ* and Diagnosis of Scrapings.

The mistakes that are apt to be made in the microscopic diagnosis of endometritis remain to be mentioned. Difficulties may arise from the great enlargement of the round cells of the stroma which accompanies inflammatory processes, and which gives them a more decidual character on account of the size and the distinctness of the cell body; it is often impossible to distinguish an individual cell from a stroma cell altered by gestation. In interstitial endometritis the enlarged cells are usually not so uniformly distributed throughout the mucous membrane as in the case of the genuine decidua. In many cases they are encountered only in the superficial layers; nor are they so uniformly converted into larger elements with large nuclei as in the case of the decidua; the irregularity which is seen here and there in interstitial endometritis decides the diagnosis. The intercellular substance also appears more homogeneous during pregnancy; the cells appear to be embedded in a soft mass, while in interstitial endometritis the intercellular substance appears more fibrillar,

Differential Diagnosis in Changes of the Stroma Cells.

The Stroma Cells Resemble Decidual Elements.

and the cells lie loosely scattered in the tissue. In cases of interstitial endometritis in which the entire mucous membrane contains greatly enlarged decidua-like elements, the differential diagnosis between the changes of pregnancy and inflammatory products is sometimes very difficult; but, as already stated, it is decided by the irregular structure which characterizes interstitial (deciduacellaris) endometritis.

The large decidua-like cells of interstitial endometritis have also given rise to confusion with sarcomatous degeneration. The important points are the occasional conversion of the stroma cells into large cells with a distinct cell body, arranged in a fairly uniform manner and, on the other hand, the atypical arrangement, which is characteristic of sarcoma. The importance of avoiding this mistake is shown at once by the therapeutic measures that are demanded by a diagnosis of sarcoma. The prognosis also is quite different.

Differential Diagnosis in Changes of the Epithelial Elements.

In the other cases, in which almost the entire uterine membrane shows decidual changes and the differential diagnosis between pregnancy and inflammation is particularly difficult, there is less danger of confusion with sarcoma; here again the absence of the atypical, as compared with sarcoma, decides the question.

Diagnostic difficulties may also be occasioned by the epithelial changes that occasionally take place in glandular endometritis. Whereas ordinarily, even when the inflammatory changes are very considerable, the typical arrangement of the epithelium in a single row of cells is preserved, peculiar proliferations of the epithelium, piling up of the cells and stratification, may be observed. The epithelial cells change their shape (metaplasia); the tingibility is modified, and with this is not infrequently associated glandular enlargement. This peculiar epithelial change, which is observed in glandular endometritis with saw-tooth formation, may give rise to error in two different ways: The changes may be mistaken for the specific changes of pregnancy, since alterations of this kind occur quite frequently in gestation. In the second place—and this is what chiefly interests us here—the epithelial changes may be mistaken for carcinoma (compare section on the Diagnosis of Malignant Diseases and that on the Diagnosis of Pregnancy). Practice, and the fact that this peculiar epithelial change in the gland usually does not progress beyond a certain stage and never forms genuine cancer nests, which are sure to be produced in one place or another in cancer, serve to prevent the error. The finding of these changes should be a warning to the examiner to think of the changes of pregnancy, simple inflammatory processes, or a beginning carcinoma.

Differential Diagnosis between Changes in the Stroma and Sarcoma.

Differential Diagnosis between Endometritis, Pregnancy, and Carcinoma.

Errors may also arise when the arrangement in a single row of cells is apparently replaced by stratification in two layers in glandular endometritis (see Fig. 320). The condition is sufficiently clear in thin sections, but the peculiar regularity and constancy of the two-layer arrangement, which does not go on to further stratification, is also of value in the differential diagnosis. It is a not inconsiderable point of distinction between glandular carcinoma of the cervix, especially malignant adenoma of the cervix, and carcinoma of the body. In the body uniform arrangement in two layers is not direct evidence of malignant degeneration; whereas in carcinoma of the cervix a uniform arrangement in two or three layers, without going on to further stratification, does occur. The cervix has a carcinoma with a single layer of cells (malignant adenoma), a malignant adenoma with stratified cylindrical epithelium (two to three rows), and a malignant adenoma with stratified (two to three rows) more round or cuboidal epithelial cells (comp. Figs. 243, 244, 245).

FIG. 321.—OBLIQUE SECTION (flat section) through the fundus of a uterine gland. The incision includes epithelial layers, but not the lumen.

Oblique or flat sections through the glands may be responsible for a mistaken diagnosis of cancer, as they form apparently solid nests of cells, or cellular structures, which appear stratified and therefore malignant (Fig. 321). Having one's attention called to the possibility, and familiarity with the pathogenesis, as shown in the scheme on page 526, will enable one to make the diagnosis. The irregularity in the arrangement of the cells and the peculiar round or oval boundary line are also suggestive.

The papillary invaginations seen in glandular endometritis may be mistaken for beginning malignant adenoma, and the same mistake may arise through the closely packed gland tubes, when the glands are greatly hypertrophied. The deeper portion of the mucous membrane in glandular endometritis, which is known as the spongy portion, may give trouble if an insufficient number of sections are studied under too low a power. On the other hand, if the specimen is examined only under high power, the closely packed glands in the spongy portion may be mistaken for carcinoma.

A well-marked endometritis glandularis papillaris with saw-tooth formation may be mistaken for beginning inverting malignant adenoma. In fact, it is difficult in the beginning to recognize inverting malignant adenoma, since it goes through exactly the same development as endometritis glandularis papillaris. The decision

must be made by the staining properties of the epithelium. In malignant adenoma the staining is peculiar and diffuse; in glandular endometritis there is a diminution in the tingibility of the epithelial cells. Finally, in inverting malignant adenoma the characteristic type of the gland is destroyed; whereas in endometritis the gland as an individual unit is preserved. In malignant adenoma no glands and no glandular lumina are seen, only epithelial cords arranged back to back.

Differential Diagnosis between Glandular Endometritis and Everting Adenoma.

The everting form of malignant adenoma is also at first difficult to distinguish from hyperplastic glandular endometritis, but the occasional presence of beginning stratification may serve as an aid. If necessary, a number of sections must be examined. A source of error for the beginner is found in the peculiar pictures produced by cutting all the epithelial ledges that proliferate into the lumen of the gland—it looks as if glands were placed within glands. On more careful examination the glands are seen to

Fig. 322.—Gland with Papillary Projection. In another section the projection remains as an isolated structure within the lumen (*b*, *c*); (*d*) circumscribed intraglandular (varicose) papillary proliferation.

contain structures which are covered with cylindrical epithelium on the outside, and therefore merely simulate glands. The genesis of these structures is shown in the diagram (Fig. 322, *a*, *b*, *c*). Occasionally very great proliferations, so-called intraglandular excrescences occur, just as intracanalicular proliferations are sometimes observed in other portions of the body, as, for example, in the mammary gland. By itself the picture might be taken for that of malignant degeneration; but if the changes occur singly, the proliferation is to be regarded merely as hyperplastic and not as a malignant process (intraglandular verrucose proliferation) (Fig. 322, *d*). In this connection it is interesting to note that the malignant and benign proliferation at first follows the same development—malignant adenoma, like glandular endometritis, has its inverting and its everting stage.

Intraglandular Proliferations.

It has already been explained that heterotopia of epithelial structures is not necessarily a sign of cancer. Endometritis shows to what extent epithelial structures may pass beyond their original boundaries and penetrate deep into the muscularis without being malignant. On the other hand, the study of malignant tumors shows

that heterotopia is not absolutely indispensable for the diagnosis, particularly in the early stage. Carcinomata and sarcomata are seen which do not extend beyond the limits of the mucous membrane (comp. also the syncytial infiltration of the uterine muscularis).

As yet inflammatory endometritis has been classified only on anatomic or histologic grounds. An etiologic classification is not practicable. There is but one form in which the structure itself points to a definite microörganism, namely, tuberculous interstitial endometritis. Instead of circumscribed inflammatory foci, the microscopic picture shows giant cells with parietal nuclei, surrounded by circumscribed areas of round cell infiltration (Fig. 323, *b*). It is not always possible to demonstrate the tubercle bacilli by staining methods, but the histologic picture is sufficient evidence of the tuberculous nature of the affection. These circumscribed inflammatory foci may be quite numerous in the mucosa. It is worth noting, and will be referred to again, that after curettage and after a microscopic diagnosis of tuberculosis has been made, a quite remarkable improvement in the general condition of the patient sometimes occurs in cases which had been apparently unfavorable.

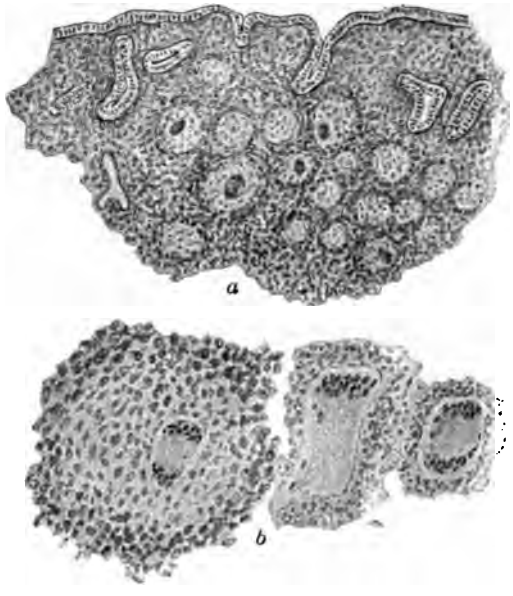


FIG. 323.—TUBERCULOUS ENDOMETRITIS. (*a*) Greatly inflamed and infiltrated mucous membrane containing paler foci in which the giant cells are seen. (*b*) The foci under higher magnification.

Cervical Endometritis.

The chief distinction between **corporeal** and **cervical** endometritis is that the former is more productive, while the latter is secretory. Indubitable inflammatory proliferation and infiltration of the stroma also occur in the cervix. The inflammatory process may begin at the surface around the glands, and we may speak of periglandular cervicitis. In addition to the interstitial forms, epithelial multiplication, numerical increase of the glands, either by dipping down of the superficial epithelium or by ramification of the trunk (comp. Fig. 246, adenoma of the cervix, in the section on The Malignant Diseases of the Uterus) are undoubtedly seen.

The epithelial structures, like the erosion glands of the vaginal portion, may penetrate a considerable distance into the tissue. The tendency to respond to an inflammatory irritant by profuse secretion, which characterizes the cervix, leads to a much greater production of ectasia or dilatation than in the case of the body. The dilated and constricted glands form visible products,—vascular structures, from the size of a pea to that of a cherry—in the vaginal portion, filled with a tenacious, glairy or slightly milky mucus, called ovula Nabothi or follicles (Fig. 324).

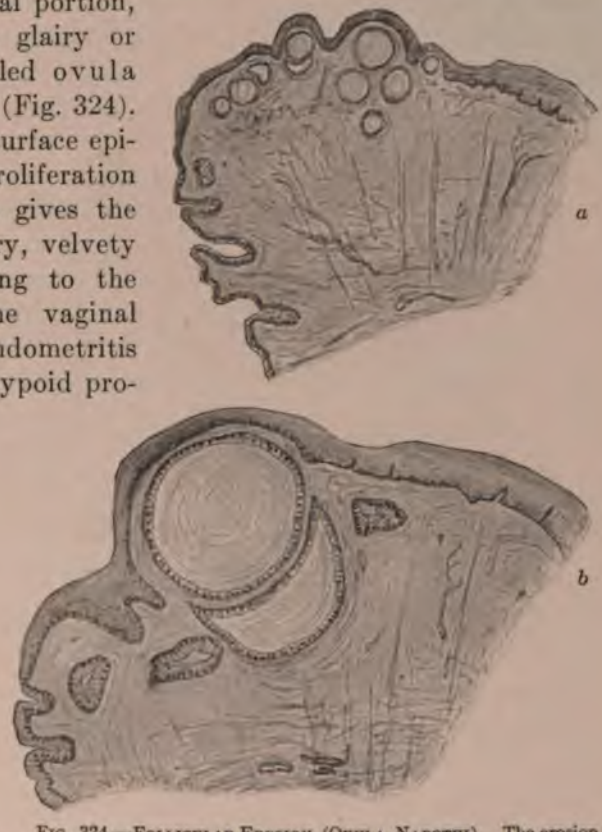


Fig. 324.—Follicular Erosion (Ovula Nabothi). The erosion glands, like cervical glands, dilate and form follicles. The follicles in the mucous membrane represent the beginning of 'follicular polyps.' (*a*) General view; (*b*) somewhat enlarged.

Proliferation of the surface epithelium associated with proliferation of the connective tissue gives the cervix a slightly papillary, velvety appearance (corresponding to the papillary erosion of the vaginal portion — Fig. 325) — endometritis cervicalis papillaris. Polypoid proliferations are often seen, frequently incited primarily by the follicular proliferations of the glands (follicular polyp and mucous polyp). Mucous polyps which contain large cystic spaces are called follicular polyps. They often exhibit considerable glandular proliferation in their interior and new formation of glands on the surface, which is often distinctly papillary. The metamorphosis that takes place in the epithelium—epidermidalization—which has been described at length in connection with erosion, is extremely interesting.

Genuine ulcers, such as are not observed in the mucosa of the body, may produce marked hemorrhages in the cervix as well as in the vaginal portion, as the inflammatory infiltration is often very vascular. As in the vaginal portion, a simple ulcer may contain erosion glands; but in the main ulcer and erosion are two separate conditions (vaginal and cervical structures). If there is clinically a suspicion of carcinoma in this condition, it can be laid only by

Cervical Ulcers.

means of a histologic examination, showing the changes of inflammatory infiltration. Whether the latter is due to syphilis or tuberculosis cannot, however, be decided. In the beginning it may be difficult to distinguish a malignant adenoma from proliferation and hyperplasia of the cervical glands; the change in the tingibility of the epithelial cells in a case of this kind is a very important diagnostic point, as has been already stated. If the epithelium of the cervical erosion stains diffusely and the characteristic position of the nucleus is lost, there must be a strong suspicion of beginning malignancy even in the absence of stratification. If the latter change has taken place and there is a uniform

FIG. 325.—PAPILLARY EROSION. Papillary excrescences grow out from the erosion glands and ultimately reach the surface. In a similar manner papillary proliferation is also produced at the surface.

extension of the epithelial proliferation (adenoma malignum cervicis), the diagnosis is clear. From the standpoint of differential diagnosis it is important not to mistake any epithelial change in the polyp for carcinoma (see above), since non-malignant changes of the epithelium after the manner of epidermidalization occur quite frequently in polypi to a considerable depth (down to the base of the polyp).

The cervical endometrium, like that of the uterine body, undergoes senile atrophy which affects all the constituents of the membrane; the projecting atrophic folds may contain whitish deposits of calcium salts.

Diagnosis of Malformations of the Internal Genitalia.

The most important malformations in the adult genitalia are those of the uterus and vagina. Developmental disturbances of the ovaries and tubes are so rare and have been studied so imperfectly and, on the other hand, the clinical symptoms which they produce are so vague, that they cannot be recognized with certainty. As for the malformations of the external genitalia, they will not be considered in this connection because they are easily recognized by inspection, and their diagnosis requires no detailed discussion.

The diagnosis of these malformations presupposes a knowledge of the development of the female genitalia, and so much of it as has a bearing on these malformations will therefore be briefly given.

The internal genitalia develop from the germinal glands and the two ducts of Müller, the Wolffian duct being represented in the adult only by an insignificant rudiment. The germinal glands develop on the inner side of the two Wolffian bodies, which lie on each side of the fetal vertebral column, while the Wolffian ducts pass downward to one side of the column. The ducts of Müller are in relation with the proximal portion of the Wolffian body and grow from this point downward along the ventral wall of the Wolffian duct, the upper portion to the outer, and the lower portion to the inner side of the duct. The two portions gradually approach one another, so that at the lower extremity they are in close contact. Accordingly they follow a convex course, with the convexity directed downward, which is accentuated by the fact that the upper end descends along with the ovary in the descent of that organ. The lower extremity of Müller's duct opens into the urogenital sinus. About the middle of their course the ducts of Müller first become fused, and this fusion gradually progresses from above downward, the upper extremity remaining separate. The septum between the fused portions gradually disappears and a common canal is thus formed. The ducts of Müller form the tubes, uterus, and vagina; the upper paired segments form the tubes, while the intermediate and distal portions unite to make the single uterus and vagina. The boundary between the double and single portions corresponds to the attachment of the round ligament. The fetal germinal glands form the ovaries; the proximal portion of the Wolffian duct in the adult is represented by the rudimentary epoöphoron (parovarium), the distal portions by the so-called ducts of Gärtner, traceable down into the region of the cervix.

The external genitalia develop from the median genital eminence and the two lateral genital folds, which form the genital furrow. Between the genital folds is the orifice of the cloaca which, as the perineum develops, divides into the urogenital sinus and the anus. The genital eminence becomes the clitoris, the two lateral genital folds, the labia majora; the genital furrow becomes the rima pudendi, the two lateral edges of which are formed by the labia minora. The perineum is formed by the fusion of the two genital folds in the median line, and the rectovaginal septum grows down like a spur from above toward the perineum.

The point where the developmental sphere of the duct of Müller meets the external skin corresponds to the hymen, which is formed by the lower blind extremity of the duct of Müller and represents the boundary between it and the urogenital sinus.

Classification. The systems devised by Fürst, Nagel and v. Winkel, which are based on the various stages of development of the internal genitalia, are of no value for diagnostic purposes. Without doing violence to the anatomical conditions, malformations may for diagnostic purposes be divided into two separate groups. The first includes all cases of insufficient development of the internal genitalia; the other embraces the double formations. The reason for including all cases of imperfect development in one group is that the subjects consult the physician for functional disturbances, amenorrhea, sterility, molimina and impotentia coeundi. Given these disturbances, therefore, the cause must be sought in some developmental anomaly, and its nature must be determined. Double malformations, on the other hand, which constitute the second group, are only found accidentally in otherwise healthy women, and give rise to definite symptoms only when they are associated with atresia.

Classification.

I. Diagnosis of Imperfect Development of the Uterus and Vagina.

This group embraces all cases of total absence, of rudimentary anlage, and deficiency of the uterus, associated with absence or deficiency of the vagina. The tubes and ovaries in most cases are fully developed, and the external genitalia are usually normal; hence fusion of the ducts of Müller is normal and their development only is deficient; while, on the other hand, the metamorphosis of the genital glands and the development of the external genitalia are normal. In these cases the physician is usually called upon to find out the cause of an absolute amenorrhea, or rarely of sterility, or impotentia coeundi.

The examination is begun by inspecting the vulva; the hair and the development of the greater and lesser labia, as well as that of

the clitoris, must be noted. In most cases the external genitalia are absolutely normal, even when the development of the uterus and vagina has been very much interfered with, because the external genitalia have nothing to do with the development of Müller's duct. The shape of the labia minora is investigated for the presence of bodies resembling testicles, as women presenting the above-mentioned symptoms are sometimes male hermaphrodites (see page 549) in disguise. The urethra must also receive attention because, although it does not take part in the malformation, it sometimes becomes greatly dilated by attempts at coitus when the vagina is absent, so that the finger can be easily introduced into the bladder.

Vulva.

The condition of the vagina depends directly on that of the introitus; if the latter is completely occluded, either the vagina may be absent altogether, or in mild cases there may be merely atresia of the hymen with a normal vagina. The distinction is most easily made by means of a rectal examination. When the vagina is entirely absent, only a few thin fibrous cords at most are felt instead of the vaginal canal. The rudimentary vagina may be more easily found by introducing a catheter into the bladder; if there is merely occlusion of the hymen, and the genitalia are otherwise perfectly developed, a hematocolpos is always present and is recognized on inspection by marked bulging of the closed hymen and a bluish color, due to the presence of menstrual blood. Through the rectum, or by bimanual examination, it is felt as a tense approximately spherical tumor filling the entire pelvis as far as the introitus, while above the uterus, which is also dilated, and possibly a bilateral hematosalpinx are found. In rare cases the vagina behind the hymeneal atresia is not filled with blood and is recognized by moving the two walls against one another. If the introitus is open, the finger is introduced and the length of the vaginal tube is determined. Quite often a short *cul-de-sac* is felt instead of the vagina. In virgins it is extremely short because it corresponds to the short urogenital sinus; but if coitus has taken place, it may be considerably elongated and dilated and may almost simulate a normal vagina. The condition of the vagina above the *cul-de-sac* can only be determined by a rectal examination with a catheter introduced into the bladder. An accurate examination is always necessary if an operation for the purpose of opening the vagina is contemplated. If the vagina is present and of normal length, the vaginal portion must be examined.

Vagina.

Examination of the uterus is the most important part of the diagnosis; accurate palpation is possible only under anesthesia, by introducing two fingers into the rectum and palpating through the abdominal walls with the other hand. Small rudiments are much

more easily found by introducing a catheter into the bladder. As the rudiments are in relation with the posterior bladder wall, palpation should be begun in the median line from the symphysis toward the promontory. If nothing is found, the investigation is continued to each side, and as the rudiments in this region usually run transversely across the pelvis, palpation is performed by keeping the fingers in close contact and moving them from before backwards, as is done in examining the tubes. If possible, the ovaries and round ligaments should also be palpated.

Uterus.

Although on careful examination no vestige of a uterus running either in a sagittal or in a horizontal direction, or even fibrous cords may have been discovered at the normal site of the organ, the diagnosis

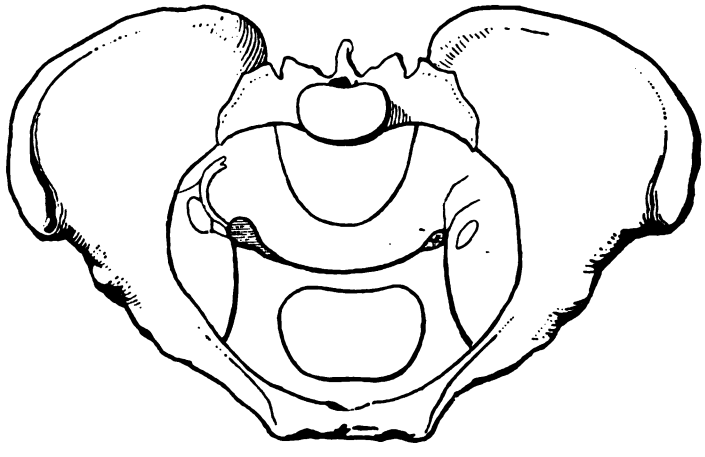


FIG. 326.—UTERUS RUDIMENTARIS BIPARTITUS (as seen at laparatomy). ⅓. (Original.) Merely a transverse rudiment with two lateral, enlarged cornua; the right adnexa are normal; on the left side there is a small ovary and two small cords corresponding to the tubes.

of complete absence of the uterus is nevertheless not justified because there may be anatomical rudiments that have escaped clinical examination, or because rudimentary cornua may have been mistaken for tubes; or finally because the individual may be a male hermaphrodite. Absence of the uterus is extremely rare in adult women. If, however, a rudiment is distinctly found in the region of the uterus, it may present various forms. In some cases there may be felt in the median line at the site of the uterus a small, round, firm body, or merely a slight thickening of the cellular tissue, which extends below to the *cul-de-sac* of the vagina, or is connected with the fibrous bands which correspond to the rudimentary vagina. This median uterus gives off rudiments which pass out laterally toward the pelvis and usually represent thin round, or flat solid cords that feel like tubes, with a swelling in the lateral portion on one or both sides corresponding to a greater

accumulation of muscle tissue, sometimes with the formation of a cavity. These lateral swellings always represent the lateral extremity of the uterine rudiment, and form a welcome boundary between the rudiment and the tubes (Fig. 326). They are very often mistaken for ovaries, an error which is best avoided by demonstrating the presence of the ovary alongside of them. Whether the uterine rudiment contains a cavity is determined by the presence or absence of hematometra, when the mucous membrane is capable of functionating. The round ligament is a positive anatomic sign of the boundary between the uterus and the tube, but on account of the difficulties of palpation it is not available clinically. After the presence of a uterus has been determined, the ovaries should be investigated and are always found in uterus rudimentaris bipartitus, the commonest form of rudimentary uterus. In many cases normal ovaries are present on each side; in other cases they are defective, depending on whether the duct of Müller alone, or with it the germinal gland has been arrested in its development. The degree of development of the ovaries is determined by their size and functional activity, by the regularly or irregularly occurring molimina. The condition of the tubes can very rarely be determined clinically.

Finally, the shape of a uterus that is too small in all its dimensions can be recognized through the vagina or by bimanual rectal examination. Two varieties, which can be differentiated by palpation, are described: In one the cervix is much longer and thicker than the body, which represents no more than a fourth or a third of the entire length of the organ, with very fine, often membranous walls (uterus foetalis). In the other form the uterus has a total length of about 4 to 5 cm.; the shape is like that of a normal uterus with an arched fundus, and the cervix is not out of proportion (uterus infantilis). In these cases the behavior of the vaginal portion gives a clue to the condition of the uterus. In uterus foetalis it is usually entirely absent, and instead of an external os there is merely a small opening in the vaginal vault. In uterus infantilis the vaginal portion is indicated, although very small, and at its apex is seen the external os. By means of the sound the presence of a cavity within the uterus is determined, and from its length the degree of developmental disturbance can be estimated; after that the size and position of the ovaries are investigated.

Differential Diagnosis. Confusion most frequently arises between deficiency of the uterus, or rudimentary uterus, and pseudohermaphroditismus masculinus externus, *i.e.*, a male individual with female external genitalia. Mention is made in the literature of a number of men deformed in this way, who contracted matrimonial

alliances as women because at birth they were pronounced females on the strength of the external genitalia. The appearance of the vulva is of no value, as it may be absolutely female in male hermaphrodites. The clitoris, labia majora and minora and even the introitus may be normally formed. A completely developed vagina is somewhat more rare in such individuals, if the deceptive cases in which the urogenital sinus has been enlarged by attempts at coitus are excluded. The diagnosis is determined by the condition of the sexual glands. The ovaries are found in their normal situation, while the testicles descend into the greater labia, where they may be distinctly felt as movable bodies (Fig. 327). The appearance of the vulva in these cases is often very misleading as it seems to establish the female sex of the individual beyond a doubt.

Pseudohermaphroditismus Masculinus Externus.

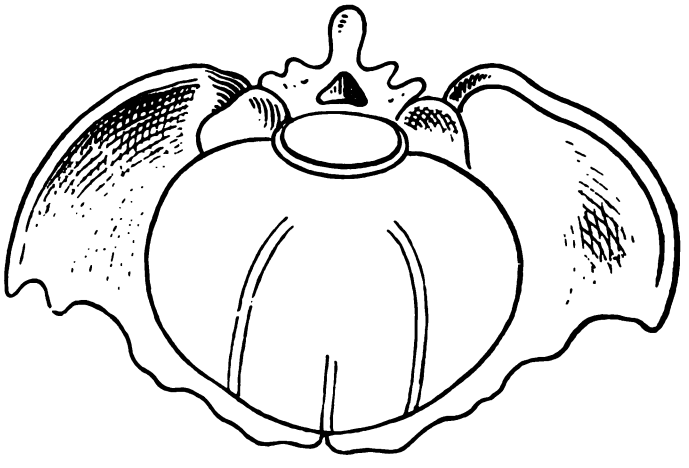


FIG. 327.— PSEUDOHERMAPHRODITISMUS MASCULINUS EXTERNUS. P.-F. ½. (Original.) The ovaries are wanting (the testicles are embedded in the labia majora). On each side the vas deferens passes downward and inward from the internal ring; its junction with the bladder cannot be palpated. In the median line in front the urethra is felt. There is no vestige of prostate or uterus masculinus.

Accordingly the testicles are not infrequently mistaken for ovaries and a diagnosis of hernia of the ovaries is made. In the first place this is a rare condition, and in the second place, the labium in such cases does not contain a testicle and epididymis. In cases of bilateral cryptorchism the diagnosis is very difficult. The uterine findings are likely to be misleading, as a masculine uterus often gives the impression of a small rudimentary organ; the larger the rudiment, however, whether it lie in the sagittal or transverse direction, the greater the probability that the individual is a woman. The bodily habit, the voice, sexual sensations, and the discharge of fluid during sexual excitement, are of no value for the differential diagnosis, because they may be either entirely absent or present in a perverted form.

II. Diagnosis of the Double Formations of the Uterus and Vagina.

Double formations of the uterus and vagina are due to the failure of the ducts of Müller to unite and form a single uterus and vagina, the structures remaining double and developing each into a complete vagina or uterus, or a segment of the organs. The degree of double formation may be extremely variable. The entire genital canal or only the upper, or the lower segment, or both at the same time may be double, while the cervix usually remains single.

These malformations are always discovered by accident; for, aside from the cases of retention in an occluded half, they produce no symptoms and are therefore not suspected.

In some cases a double vagina is discovered at the examination by the fact that each of the two fingers enters a separate vagina; or by finding a different condition at the vaginal portion in the two vaginas. Double vagina is apt to be overlooked when one half is rudimentary and the septum is near the vaginal wall, unless there is an opening below and the rudimentary half can be demonstrated with the sound. A partial septum is much more easily recognized if situated below, because the lower border can be felt. Once the suspicion of divided vagina has been aroused, it is confirmed by finding a double introitus or by discovering a septum between the two fingers. A torn septum is more difficult to recognize; it is usually situated at the posterior wall and projects as a piece of mucous membrane from the vulva. In other cases a mere suggestion of a septum in the form of a slightly thickened prominence in the median line of the anterior or posterior wall is found. The existence of double vagina is strong presumptive evidence of the same formation in the uterus.

Vagina Septa.

Vaginal Portion. In rare cases, two completely formed vaginal portions, each with a normal external os, are found. The vagina is always double, each half containing a vaginal portion, except in very rare cases in which the lower portion of half of the vagina is rudimentary, when both vaginal portions are found in the normally formed vaginal half. The double vaginal portion always points to very complete division of the uterus, either uterus didelphys or uterus bicornis duplex. In most cases the vaginal portion is single, and the division begins higher up in the cervix; the latter is usually broad and occasionally divided in the median line by a vaginal septum or raphe. Accordingly the external os may be single (uterus bicornis uniforis) or double; this anomaly of the portio is usually associated with well marked double formation of the uterus, with the exception of the cases of uterus septus biforis—a single uterus

Double Vaginal Portion.

with a double external os. If the external os is single and wide open, as in multiparæ or during parturition and in the puerperium, the finger may be introduced for the purpose of determining whether the cervix is single (uterus bicornis unicollis), or whether it is divided by a septum coming down from above, and how far the septum extends downward. If during parturition or in the puerperium the vaginal portion is found to be incompletely formed, there is danger of mistaking the lower extremity of the divided cervix for a double external os.

The greatest significance obviously attaches to double formation of the uterine body and the adjoining portion of the cervix. This may be determined either by bimanual examination with two fingers through the rectum, under anesthesia, or by the introduction of two sounds into the two halves of the uterus. In the mildest cases of double formation the uterus is single, although greatly broadened at the fundus and somewhat retracted in the middle, with occasionally a median longitudinal furrow (uterus arcuatus). Although externally there may be merely a suggestion of duplication, the cavity may either be single, with only a small spur at the fundus corresponding to the retraction, or divided from above into two halves by a septum (uterus septus). This septum is at once demonstrated if during parturition, abortion in the puerperium, or after dilatation the finger can be introduced into the cavity. One feels the free border of the septum, and it is easy to determine by entering both cavities how far down the septum extends. If the cervix is closed, the presence of a double cavity is demonstrated by introducing the two sounds at the same time, and finding that they do not touch each other in the divided portion. If the septum does not extend the entire length of the organ, we speak of uterus subseptus, and this again is subdivided into uterus subseptus unicorporeus, unicollis and uniforis, depending on whether part of the corporeal cavity, or only the cervix, or only the external os is single.

Double Uterus.

Uterus Arcuatus.

Uterus Septus.

But if on palpation the body of the uterus is found to be distinctly divided from above, the condition is either uterus bicornis or uterus didelphys. If the two cornua are close together they are readily recognized as the two halves of the divided uterus; but if they unite below at a very obtuse angle, there is a tendency to mistake one cornu for a subserous myoma on account of its pedunculated connection with the other. The oblique position of the uterus, it is true, points to a double formation; but by introducing the sound, and by palpating the adnexa and noting their consistency, it is usually possible to distinguish the two structures (see page 278). After both cornua have been positively recognized, the extent of the division must be deter-

mined. If the two cornua unite at the internal os, the condition is a uterus bicornis infrasimplex (Fig. 328). The cervix is usually thicker and broader and may be more or less completely divided by a septum from above (uterus bicornis uniforis, unicollis). But if two cervices are found by palpation, the anomaly is a uterus bicornis duplex if their median surfaces are barely connected, and a uterus didelphys if the two cervices are also completely separated and held together only by loose connective tissue. The lower down the duplication extends, the more easily it is recognized, and two completely divided uteri can be palpated with as much accuracy as two separate organs; nevertheless the diagnosis is much easier if two sounds are introduced for the purpose of stiffening the two uteri. The distinction between uterus didelphys and uterus bicornis duplex is often by no means easy, on account of the difficulty of determining the width of the connection between the two, especially if during parturition the connective tissue is very much softened. The width of the connection is determined most easily by moving the uteri against one another. The uterus is often twisted in these cases of double formation, with one cornu, most frequently the left, rotating forward and the other backward.

Uterus Bicornis.

Uterus Didelphys.

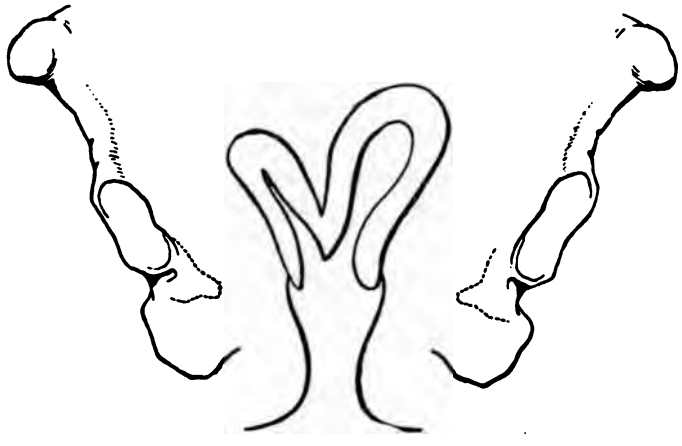


FIG. 328.—UTERUS BICORNIS INFRASIMPLEX. P.-F. ⅓. The left cornu is large, 9 cm.; the right smaller, 6.5, cm. The division extends to the region of the internal os; the septum in the cervix extends almost to the widely dilated external os.

If, instead of uniform development of the two ducts of Müller into the uterus and vagina, one of them develops normally and the other remains undeveloped or rudimentary, a different kind of clinical picture is produced. On one side there is a uterus (uterus unicornis) and on the other side nothing, or merely a rudimentary cornu, often associated with an equally rudimentary vagina. The diagnosis of this condition is usually made only by accident; but if a pregnancy

develops in the rudimentary cornu, or menstrual blood or pus is retained the resulting conditions may be most grave and even threaten the patient's life, hence the diagnosis is of the greatest importance (see below and page 174).

The diagnosis of a simple uterus unicornis is based on the shape and position of the organ. As it is developed from a single duct of Müller, the uterus is accordingly narrower, thinner, long drawn out, without a true fundus, and very slender where it joins the tube. In accordance with the position of the duct the organ is oblique, or almost transverse, and there are no adnexa on the median side; if there is a rudimentary cornu on the other side, the diagnosis will depend on its degree of development. A thin, thread-like cornu is difficult to feel, except the swelling which is occasionally found at the lateral extremity, but which may again be mistaken for an ovary. If it approximately attains the thickness of a normal tube it may be palpable if the abdominal walls are not too thick; the depression is always immediately above the external os. If the rudimentary cornu is thicker than the tube, it can be felt like a subserous myoma projecting by a pedicle from the inner margin of the uterus; if there is a communication with the uterine cavity, and the sound can be introduced into the rudimentary cornu, it is evidence that the latter contains a cavity. When the connecting piece is massive, the presence of a cavity in the lateral portion of the cornu may be assumed if pregnancy or retention tumors develop in it.

Uterus Unicornis with Rudimentary Cornu.

The importance of this double formation is increased if the menstrual blood, or mucoserous fluid, or pus (hemato-, hydro-, pyo-metra or -colpos unilateralis) forms behind the closed extremity or in a closed portion of a double vagina. The symptoms produced by the tumors are so severe that a physician is always consulted. On the whole, these conditions are extremely rare. The diagnosis of these retention tumors is extraordinarily difficult and is made only if the physician happens to think of them. It depends on the demonstration of a fluctuating tumor associated with a double uterus; but the diagnosis of the malformation is rendered more difficult by the fact that, as the fluid accumulates, the tumors lose all the properties of a uterus or vagina. If only a single sign of double formation is found, either in the uterus above, or more frequently in the vagina, the existence of a hematometra or pyometra in the rudimentary horn becomes extremely probable. The shape of the tumor is approximately round or oval, and if the wall is not too thick, the consistency is cystic. Its position alongside of the functionating uterus depends on the extent of the division; if a tumor forms in the lateral portion of the rudimen-

Retention Tumors in a Rudimentary Uterus.

tary cornu, its distance from the uterus will be so great that the examiner will always think first of an ovarian tumor. A positive diagnosis is hardly conceivable unless the origin of the corresponding tube and ovary is found on the external surface, or the symptoms are very severe; on the other hand, retention tumors in a uterus bicornis or uterus didelphys are much more closely connected to the sound half. The width of the connection depends on the kind of double formation present. In uterus didelphys the outline of the open uterus is most easily determined; in uterus bicornis the tumor is usually so close that the angle between the two cornua is difficult to demonstrate; in uterus septus the retention tumor occupies a portion of the uterus itself, and the empty half can be recognized only with the sound. The physical

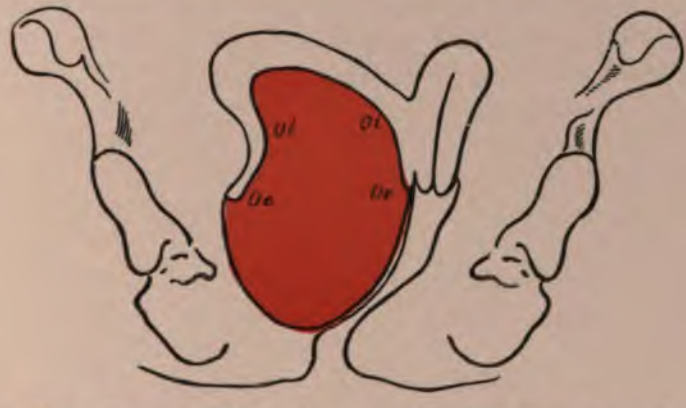


FIG 329.—UTERUS BICORNIS AND VAGINA SEPTA WITH OCCLUSION OF THE RIGHT VAGINA. P.-F. ⅓. (Original.) The vagina is constricted on the right by a fluctuating tumor half as large as a man's head, which extends almost to the introitus; on the dome of the tumor the right cornu can be felt running almost transversely; the left cornu can be distinctly outlined. After incision the vestiges of the external and the internal os can be felt in the hematocolpos sac. The adnexa are normal.

signs are also greatly modified according to the quantity of fluid in the rudimentary half of the genital canal. If the retention tumor is chiefly or entirely limited to the uterine cornu, the sound half is merely crowded over to the other side, where it may be demonstrated by palpation or with the sound; if the cervix also is involved, the vaginal vault on the corresponding side is crowded downward, the septum in the cervix is pushed far down into the lumen, and the canal narrowed to a cleft; finally, if the occlusion is situated low down, and the vagina is also distended, the fluctuating tumor is found below, forcing the septum far downward into the lumen of the vagina, while above is found the dilated uterus (Fig. 329). In the last-mentioned cases we find a fluctuating tumor broadly attached to the entire width of the genital tube.

The symptomatology is so important in these tumors that a definite diagnosis cannot be arrived at without giving it due consideration. The occurrence of severe dysmenorrheic pain without disturbance

of menstruation, and a gradual increase of the symptoms associated with slow growth of the tumor, which may take place at each menstruation, are characteristic; the interval between menstruation is usually quite free from pain. This regularity and intensity of the symptoms, however, presupposes normal functional activity of the atresic cornu; but very often the cornu is undeveloped, and menstruation is irregular and scanty. In such cases the coincidence of the pain with the menstruation is not so well marked, and the growth is exceedingly slow. Finally, if only mucus and pus accumulate in the tumor, the menstrual symptoms are entirely absent, although slow growth of the tumor goes on hand in hand with an increase of the pain.

The differential diagnosis between hematometra and hydrometra is based on this symptom alone; while pyometra may be recognized by the presence of fever, the leukocytosis which often accompanies it, and the associated inflammation.

Diagnosis of Diseases of the Urinary Apparatus.

Physiology. In order to understand the different disturbances of urination which form the starting point for the diagnosis of these conditions, I shall explain the physiology of urinary secretion.

The urine which escapes from the renal pyramids collects in the pelvis and flows into the ureter. As soon as the urine enters these canals, the muscularis contracts reflexly and the urine is propelled by a succession of wavy contractions into the bladder, which it enters rhythmically at intervals ranging from a few seconds to one or two minutes. So long as the bladder is empty, the upper wall closes down over the lower like an inverted dish. The first urine collects in the lateral pouches and gradually separates the upper from the lower wall; certain divisions are thus formed by the adhering bladder-wall, until gradually the roof and the floor are completely separated. Until the bladder is distended by a large quantity of fluid it retains its flat and relaxed shape. Continence of the bladder is effected by means of the small muscles of the sphincter internus, which surrounds the neck of the bladder and produces a permanent, elastic, tonic closure. In addition the posterior half of the urethra is surrounded by transversely striated muscle, which is under control of the will, and is called into action only when the closure of the bladder is to be reinforced actively. When the bladder is filled to a certain point, the fact is conveyed to the individual's consciousness through sensory fibres. A distinction is to be made between the sensation of a full bladder, due to distention of the viscus and felt as a full pressure in the lower abdomen, and true desire to urinate, which always originates in the neck of the bladder. As the distention continues, the region of the posterior fold of the internal orifice is obliterated or distended, and the urine enters the neck of the bladder, producing the desire to urinate. The sensation is probably produced directly by contraction of the striated muscle surrounding the urethra. Under pathologic conditions the sensation is frequently exaggerated, until it becomes a genuine pain. During evacuation of the urine the muscle is allowed to relax, either voluntarily or reflexly, thus opening the urethra. The urine then escapes from the bladder merely under the influence of intra-abdominal pressure. The mechanism of urination may be compared to the escape of the contents of a pot after a stopper in the bottom of it has been removed; just as the fluid escapes under the influence of air pressure after an opening has been provided, so the

urine escapes from the bladder after the closure has been relaxed. Certain differences in urination, such as the force of the stream, depend on the degree of intra-abdominal pressure; spontaneous urination can take place only while the intra-abdominal pressure is positive. The acclerator urinæ takes no part in urination; it merely renders the wall of the bladder elastic so that it may accommodate itself to its contents; possibly it may be responsible for the expulsion of the last few drops of urine. As the urine escapes, the bladder becomes smaller and the intra-abdominal pressure forces the upper wall down on the lower, beginning in the median line. Concentric contraction of the bladder does not occur, and some urine usually remains in the lateral pouches.

The diseases of the urinary apparatus that interest the gynecologists are subdivided according to the individual organs into diseases of the urethra, bladder, ureter and kidneys.

Diseases of the Urethra.

The diagnosis of urethral diseases necessitates a number of methods of examination which differ from those ordinarily employed in gynecology and therefore require a separate description.

Methods of Examination. Inspection. The patient is placed on the operating chair and the following points are noted: the position and size of the external urethral orifice; color and degree of swelling of the urethral mucous membrane; the swelling of the fold surrounding the urinary meatus; the urethral secretion; the presence of macules or reddening of the vestibular mucous membrane around the urethral orifice; and the presence of tumors at the urethral orifice.

Methods of Examination. Inspection.

Palpation. The degree of swelling and sensitiveness of the urethra may be determined by introducing the finger into the vagina, and larger tumors along the canal may be detected in this way. Palpation of the inner surface of the urethra is rarely necessary and is employed only if the results of sounding and endoscopy are unsatisfactory. It is not altogether without danger because it requires dilatation of the urethra.

Palpation.

With palpation is combined the demonstration of a urethral secretion by milking the urethra from behind forward with the finger introduced into the vagina, the external orifice having previously been cleansed of any vaginal secretion that may adhere to it. The quantity and nature of the secretion are determined and a smear is made for the purpose of looking for gonococci. Unless the secretion is very abundant, nothing will be obtained immediately after a urination; hence the examination should be made a few hours later, or, if there is very little secretion, early in the morning before the urine accumulated during the night has been discharged.

Demonstration of Urethral Secretion.

Examination with the sound is very important in the diagnosis of certain urethral diseases. A sound with a moderately thick head can be introduced without difficulty into a normal urethra if the mucous membrane is smooth and painless. The sound is employed chiefly for the purpose of detecting circumscribed areas of pain or irregularities, contractions of the lumen, or tumors in the urethra. Sounding.

Endoscopy is much less important in females than in males because the various urethral diseases can be recognized with certainty by palpation, by sounding, and by examining the secretions. It is therefore employed only in the presence of certain special indications. In chronic cases of urethritis with very little secretion and absence of swelling it is valuable for confirming the results of sounding, because it permits inspection of circumscribed changes in the urethral mucous membrane. It is also necessary in cases of hemorrhage from the urethra when urination is associated with severe pain that cannot be explained by recent inflammation. In cases of this kind one is prepared to find polyps, tumors, or foreign bodies in the urethra, and quite frequently such conditions must be differentiated from purely nervous states. Casper's endoscope is the best instrument for endoscopy of the female urethra.

Fig. 330.—Casper's Endoscope for the Female Urethra.

The upper extremity of Casper's endoscope is provided with a handle containing a large incandescent lamp, which by means of lenses and prisms projects the light into the tube at a right angle. The observer looks into the tube directly above the prism, and is enabled to study the changes in the urethral mucous membrane under full illumination (see Fig. 330).

For the successful performance of endoscopy the urethral orifice must be wide enough to admit a tube about 7 mm. thick; if not, it must be dilated with blunt dilators. The introduction of the tube from before backward is painful, but has the great advantage over examining from behind forward that the observer is not constantly disturbed by the flow of urine from the bladder. If the urethra is too sensitive, one to two grams of a 10 per cent. solution of cocain is injected five minutes before the tube is introduced. If the examination is made from behind forward, the bladder must first be completely emptied, and even then the urethra as well as the tube has to be constantly sponged in order to keep them dry. The normal urethra appears in the tube as a cleft, which

represents the lumen surrounded by the radiating folds of the mucous membrane. The mucosa is reddish and, in the posterior segments, sometimes purplish because of the many veins. The lacunæ in the mucous membrane are recognized by their elevated border. Littre's glands cannot usually be seen distinctly. As the end of the tube glides through the internal orifice into the bladder, the much paler vesical mucous membrane appears in the opening, and urine begins to flow.

Operative Opening of the Urethra.

Operative opening of the urethra, by means of a lateral and bilateral incision carried backward about one to one and one-half centimeters, is employed only after all other means have failed, as, for example, in cases of circumscribed tumors, especially when immediate removal is contemplated.

Examination of the urine is of no special importance in the diagnosis of urethral diseases. While it is true that abnormal constituents, such as pus, blood, or particles of tumors, may be mixed with the urine, they are much more easily recognized by expressing them directly from the urethra. The main object in examining the urine in urethritis is to determine whether the bladder is healthy. For this purpose the urine must be obtained before it has been polluted by abnormal constituents from the urethra (catheter specimen); but in acute, and especially in infectious diseases of the urethra, catheterization is always attended by the dangers of infecting the bladder and is therefore contraindicated. In such cases Thompson's method of collecting the urine in two separate glasses must be substituted. The patient first flushes the urethra with a certain quantity of urine and, after the vagina has been closed off with a tampon, the remainder is discharged into a separate glass and used for the examination.

Examination of the Urine.

Thompson's Two Glass Method.

Urethritis. Urethritis is the most important of urethral diseases. In the acute stage its recognition is easy; in chronic cases and in the presence of sequelæ it may be exceedingly difficult. In very acute inflammations the tissues around the external orifice are swollen and edematous. The urethral mucous membrane is intensely reddened in chronic forms, particularly in gonorrhea; the mucous membrane surrounds the urethral orifice, is reddened and macular, and sometimes the orifice is surrounded by condylomata acuminata. In recent cases the infiltrated urethra can be felt through the vagina as a thick, cylindrical, painful cord, which in a slighter degree may even be recognized in chronic cases. The presence of a secretion is the most important diagnostic point. The normal urethra is perfectly dry, and if fluid can be expressed, it indicates some alteration of the mucous membrane. In very recent cases pure yellow pus can be expressed in thick drops; after one or two weeks the flow of pus ceases and the

Urethritis.

secretion becomes whitish. In this form, consisting principally of desquamated epithelium, it may persist for months or years and is one of the surest signs of chronic urethritis. The last stage of the secretion, which may continue for a long time, consists in a moderate degree of epithelial desquamation; finally, the secretion may cease altogether, leaving merely an irritative condition of the urethra which causes considerable discomfort during micturition. In the diagnosis of these cases, in which the patient complains of tickling and burning, prickling and itching, a "funny" feeling after urination, associated with a moderate degree of strangury, the sound is the most useful instrument. The slightest touch, particularly in the posterior urethra, produces pain and the same sensations as are felt during urination; sometimes irregularities are felt which are particularly sensitive to pressure. The location of these painful sensations can be detected with a fair degree of certainty and differentiated from vesical irritation by means of the sound. There is rarely any occasion to resort to endoscopy after using the sound, except possibly in cases of persistent urethral symptoms in which neither the examination of the secretion nor sounding yields any positive result. Personally, I have never felt the necessity of resorting to the endoscope in these cases, and therefore am unable to describe the pictures seen from my own experience. I shall accordingly follow Janowski, who describes a chronic circumscribed form. In the first place, the wall of the urethra is diffusely infiltrated and exhibits rough unyielding folds; in some places dense infiltrations are detected, which form heavy, yellowish-red folds on the surface of the mucous membrane, projecting into the tube. In the areas in process of healing the epithelium appears gray or the color of mother of pearl; strictures are rare. In the circumscribed form, infiltration is seen around the lacunæ and Littré's glands; the epithelium is slightly gray and extremely vulnerable at the surface. As healing takes place the entire infiltrated zone is covered with delicate, distinctly retiform strands of cicatricial tissue, which gradually flatten out and become white; this is often attended with moderate constriction.

Tumors of the Urethra. I shall use the word "tumor" to describe any circumscribed swelling of the urethral mucous membrane, whether it projects from the external urethral orifice or lies within the lumen of the urethra. The only conditions that possess practical importance are polyps of the urethral mucous membrane, condylomata acuminata, mucous polyps (caruncles), and carcinoma of the urethra. The diagnosis of these tumors is easy when they are situated at the edge of the orifice, or within it, and project from the lumen of the urethra at least far enough to allow the apex of the tumor to be seen. Under these circumstances they may be brought

Tumors of the Urethra.

into view a little better by pushing them forward with the finger through the vagina, or having the patient bear down. It is always desirable to see the greater portion of the tumor, particularly its point of insertion. The diagnosis is much more difficult if the tumors are situated so far within the urethra that they cannot be seen. In these cases the presence of a tumor (or of a foreign body) is suggested by the severe irritation that attends urination. Cramp-like pains radiating into the vulva, the anus, and often into both thighs; cramps in the floor of the pelvis, with violent tenesmus of the sphincter ani; and hemorrhage from the urethra may also be present. The actual presence of a tumor is demonstrated with the sound or the endoscope. In making the differential diagnosis of the above-named conditions, we must determine by means of the sound or the catheter their relation to the orifice, and the presence of the urethral lumen in or alongside of the tumor.

Prolapse of the urethral mucous membrane always causes alteration of the lumen. In circular prolapse the lumen is seen at the centre of the tumor; in partial prolapse of one wall the lumen is crescentic and crowded over to the other side. Another sign of prolapse is the ability to replace the relaxed mucosa and restore the canal, while at the same time the absence of circumscribed thickening in the wall is determined by simultaneous palpation through the vagina. The prolapsed mucous membrane presents every shade of red and, if gangrene is present, which is frequently the case, its color is a dirty brownish-red.

Prolapse of the Urethral Mucous Membrane.

Condylomata acuminata are recognized by their rough, papillary surface and pale red color; they are painless to the touch, usually multiple, especially at the vulva, and associated with signs of catarrh. Sometimes they coalesce to form cauliflower-like growths around the urinary meatus.

Condylomata Acuminata.

Caruncle or mucous polyp (vascular polyp) is almost always solitary and situated at the edge of the external urethral orifice. The surface is covered with smooth mucous membrane with an indented, pectinate border; the color is bright red and the tumors are exceedingly painful, both spontaneously and on contact, and occasionally produce cramps and vaginismus.

Caruncle.

Primary carcinoma situated at the external urethral orifice is rare; it resembles cancer of the vulva and is characterized chiefly by the infiltration at the base and the friable nature of the surface. Periurethral carcinoma is more common. Beginning in the urethra itself, it produces marked infiltration and a cartilaginous elastic swelling of the urethral fold; this is very characteristic and easily distinguished from inflammatory swelling, which is much softer.

Carcinoma.

Sarcoma is exceedingly rare. It begins in the deeper layers, causes bulging of the mucous membrane and dilatation of the urethral orifice, from which the tumor may project.

Circumscribed tumors of the wall developing within the urethra may be sarcomata, fibromata, or mucous polyps; not infrequently they can be felt directly with the sound. Endoscopy of the urethra is of great importance in these cases. Ebermann has described the endoscopic findings with small tumors in the urethra. At the point of attachment the normal longitudinal folds disappear and, if the urethra is greatly distended, those in the entire neighborhood also. The surface of a polyp appears smooth and intensely red, while papillomata have an uneven surface and in some places throw a circular shadow. Forced dilatation and digital exploration of the urethra is a method that is much more severe than endoscopy. If a positive diagnosis cannot be made by the methods so far described and a tumor is suspected, it is better to divide the urethra on both sides instead of resorting to forced dilatation, and in case the diagnosis is confirmed, to remove the tumor at once.

Tumors of the bladder, as well as urethral tumors, may grow into the urethra and force their way out from the external orifice.

Calculi and foreign bodies are easily recognized with the sound or with the endoscope.

Diseases of the Bladder.

From the standpoint of the practitioner it is more advisable to begin with certain symptoms for which his advice is sought, and look for their causes, before discussing the diagnosis of the individual diseases of the bladder. A systematic description would be of no value for diagnostic purposes. Most patients come to the physician on account of symptoms occurring during urination—usually increased and painful micturition, or pain during the act (tenesmus vesicae, dysuria); rarely on account of incontinence of urine, or difficult or impossible urination (ischuria). In rare cases the patient seeks advice solely because she has noticed changes in the urine (hematuria). It then becomes the physician's duty to investigate the cause of these symptoms and make his diagnosis of the disease. Along this path I propose to guide him.

Diagnosis of the Causes of Tenesmus Vesicæ (Dysuria).

Definition. Before discussing the diagnosis of this exceedingly common complaint, it is necessary to define the term "tenesmus vesicæ." The frequent desire to urinate is not in itself pathologic; for, while it is true that a healthy woman does not urinate oftener than four or five times a day, and not at all at night, habit, the quantity of fluid ingested, and emotional excitement frequently

Definition.

cause increased micturition under otherwise normal conditions. These conditions, however, I shall omit altogether, and confine myself to that form of dysuria which is so intense and so painful as to bring the patient to the physician; or at least forms the most prominent symptom of her disease. First of all, we must make sure that the urination actually is abnormally frequent, as the patient's ideas on this subject are often very curious. Nocturnal micturition, however, is always to be regarded as abnormal. Next, we must determine that the desire to urinate really does occur prematurely, *i.e.*, when the bladder contains but a small quantity of urine, and that the frequent micturition is not also associated with the evacuation of a large quantity of urine, as, for example, in diabetes and interstitial nephritis. Micturition is to be regarded as pathologic when the desire to urinate is excited by small quantities of urine, when it cannot be suppressed, and when it is attended by pain. This form of pathologic micturition occurs in diseases of the urethra; in diseases of the bladder; in diseases near the bladder, especially of the internal genitalia; and, finally, as a purely nervous symptom. Among all these, diseases of the urinary organs are the most important.

In searching for the cause of dysuria, it is best to begin by examining the urethra. (For the methods and findings, see pages 558 to 563).

If the cause of dysuria is not found in some urethral condition, we turn to the **bladder**, and begin with examination of the urine.

Examination of the Urine.

Of all the methods of examination uranalysis is the least troublesome to the patient, requires the least technical skill, and in the majority of cases the data obtained are entirely adequate for a diagnosis. In the main it consists in recognizing diseases of the bladder by the presence of abnormal constituents that are mixed with the urine, or changes in the urine which have taken place in the bladder. The urine must be obtained free from admixture, with nothing derived from other organs. As in women it is very difficult to avoid pollution with vaginal secretion, the urine should always be obtained by catheter. In recent gonorrheal urethritis, or if catheterization is impossible for other reasons, the two-glass method must be employed. In using a glass the bladder should be completely emptied and special attention must be paid to the last of the urine in which sediment and blood usually collect. To determine whether a sediment is present, it is not enough to examine the urine in the chamber, or even in a large urine glass; nor is the "little bottle of urine" that the women usually bring along with them adapted for an accurate examination. The urine should be collected in a thin, high glass receptacle with a base, of a capacity of 80 to 100 grams; or received directly into test-tubes, in which, when held up to the light, the most minute sediment can be seen with the unaided eye in the narrow column of urine.

If the urine in a thin glass appears perfectly clear, vesical disease can be excluded with a very great degree of probability; but if the urine contains a sediment, examination of the latter affords a very convenient method of diagnosis. Simple inspection is rarely enough. The coarse, pink sediment which is precipitated from highly colored urines as they cool is of course at once recognized as urates; again, uniform turbidity in a recent urine, without the formation of sediment, indicates numerous bacteria; and a uniform distribution of minute particles in suspension points to the admixture of organic elements, such as pus or epithelium; blood also can easily be recognized in the urine. In most cases, however, chemical and sometimes microscopic examination of the sediment is necessary.

NOTE. I shall give only the important elementary chemical and microscopic urinary tests, and refer the reader for the details to the text-books of Posner, Ulzmann, Zülzer and Oberländer.

The chemical examination is begun by warming part of the urinary sediment in a test-tube. If the sediment dissolves completely it consists of sodium urate; if it does not dissolve, a few drops of acetic acid are added, and if this clears up the sediment, the urine contains phosphates; whether these are earthy phosphates (phosphates of alkaline earth) or triple phosphates (ammonium and magnesium phosphates) is best determined by microscopic examination. If the sediment is not dissolved either by heat or by the addition of acetic acid, it probably consists of cellular constituents—pus, epithelium, blood—or bacteria; if the sediment becomes more cloudy on heating, there may be an increased excretion of phosphates, or the precipitate may be albumin; the former are dissolved by the addition of a few drops of acetic acid, which does not affect albumin or even causes it to coagulate still more firmly.

Chemical Examination.

If chemical analysis shows the presence of an organic sediment, it must be followed by microscopic examination. If the sediment is abundant, a specimen may be obtained by allowing it to settle in a conical glass or in a filter paper; if it is scanty it must be precipitated in a centrifuge. By means of the centrifuge sediments can be recognized which would otherwise escape the examiner's notice; by its aid the diagnosis of diseases of the bladder has become very much more accurate, and the field of so-called nervous diseases of the bladder considerably narrowed. Normal urine contains no sediment, or at most a small quantity of mucus with a few desquamated squamous epithelial cells. The first thing to look for under the microscope is pus, which is the most positive sign of inflammatory changes in any portion of the urinary apparatus, from the urethra to the parenchyma of the kidney. Pus is recognized without

Microscopic Examination.

any difficulty. In the unstained preparation, the round, sharply outlined pus cells may easily be distinguished under feeble illumination from all other admixtures of the urine. In alkaline urine they occasionally swell up and their contours become somewhat blurred, so that they are less distinct. Polynuclear pus cells are most easily recognized after the specimen has been stained with an anilin dye. The origin of the pus, whether from the bladder or from the urinary apparatus, cannot be determined with the microscope. Next in importance are the epithelial cells; they are rarely found in normal urine, but are more or less abundant in pathologic conditions; they occur in small aggregations, or even in large shreds; they are of the squamous variety, cuboidal, with prominent corners and retracted edges, and sometimes caudate. After prolonged exposure to the action of the urine, they swell up and their contours become indistinct. The origin of the cells cannot be determined by their microscopic appearance, but their presence in large numbers and coherent pieces is of pathologic significance. The presence of blood, whether in the form of well-preserved red blood cells, or washed out, degenerated cells, or merely pigment, must be noted; its origin, whether from the bladder or the kidney, cannot be decided by the microscope. Large quantities of mucus, either in the form of uniform glairy layers, or of individual mucous corpuscles, are often found suspended in the urine. The presence of microörganisms is very important from the etiologic standpoint; they may be demonstrated by the dry method, in the hanging drop, or by staining a specimen with an anilin dye; for identifying the different varieties an oil immersion lens is required. In ordinary practice the most important bacteria are gonococci and tubercle bacilli. Amorphous and crystaline precipitates are also found, either with organic sediment or without it. Amorphous urates and needle- or rosette-shaped urate crystals and phosphates, thorn-apple crystals of ammonium urate, yellowish whetstone crystals of uric acid, the square envelope-shaped crystals of calcium oxalate, and the coffin-shaped crystals of ammonium and magnesium phosphate are the most common.

The odor of the urine has only a very subordinate diagnostic significance. In infectious cystitis with ammoniacal decomposition the sharp, pungent odor of ammonia is noted; while in chronic cystitis, particularly of gonorrheal origin, the urine is generally not decomposed and odorless. If the bladder contains necrotic tumors, the urine has a fetid odor.

Odor.

The reaction of the urine becomes alkaline in cystitis with ammoniacal decomposition, and occasionally also in disturbances of metabolism.

Catarrh of the bladder is by far the most common cause of dysuria and can be diagnosticated by examination of the urine alone.

The urine contains catarrhal secretion, consisting chiefly of pus and bladder epithelium. The quantity of pus may be exceedingly variable. In acute forms it is often so abundant that it forms a heavy sediment; while in chronic, and especially gonorrheal cases, the quantity is often so small that it cannot be recognized as a sediment. If large quantities of pus are constantly found in chronic cases of catarrh of the bladder, some other source must be suspected, such as the formation of diverticula, perforating abscess, pyosalpinx, or suppuration of the kidney. The presence of pus is always one of the most important signs of catarrh of the bladder, but occasionally it may point to suppuration higher up. Whether the pus is derived from the bladder or the kidney can be determined only with the aid of the cystoscope. Epithelial cells are found in addition to pus in catarrh of the bladder in acute cases, often in large coherent masses. In chronic catarrh, and sometimes after recovery from an acute condition, epithelial desquamation may continue for some time with moderate subjective symptoms. Whether the epithelial cells are derived exclusively from the bladder cannot be decided by the microscope. Blood is found only in acute vesical catarrh, intimately mixed with pus; protracted or repeated hemorrhages and large quantities of blood without pus always suggest some severe disease of the bladder or kidney. Mucus is usually present in catarrh of the bladder. With regard to microörganisms, a large number of bacteria in the urine usually indicates catarrh due to external (catheter) infection; in gonorrheal cystitis no bacteria, not even gonococci, are found as a rule. An alkaline or neutral reaction in connection with the presence of organisms, triple phosphates and pus, suggests vesical catarrh, particularly the form which is apt to follow the use of a dirty catheter; in gonorrheal cystitis the reaction of the urine is usually normal, and in tuberculosis it is usually excessively acid. Ammoniacal odor of the urine occurs in catarrh with decomposition, but a normal odor does not exclude the presence of catarrh.

Urinary Findings in Catarrh of the Bladder.

Chemical and microscopic examination of the urine in most cases affords all the data necessary for a positive diagnosis of vesical catarrh; hence cystoscopy should not as a rule be employed on account of the danger of infection and the procedure is absolutely contraindicated in acute cases.

But in protracted and severe catarrhs cystoscopy must be employed in order to search for the cause which produces and keeps up the catarrh, such as a foreign body or a calculus; whenever there is a suspicion of some specific infection, such as tuberculosis; or when with but slight urinary changes the subjective symptoms are intense, in order to discover unusual complications, such as ulcers.

The **cystoscopic picture** in cystitis is very complicated, being composed of hyperemia, swelling of the mucous membrane, ecchymoses, ulcerations, and the pathologic secretion of the diseased bladder wall.

Hyperemia produces dilatation of the vessels, both of the medium sized and smaller veins and of the capillaries. The number of blood-vessels is greater than normal, and they appear either as ramifying,

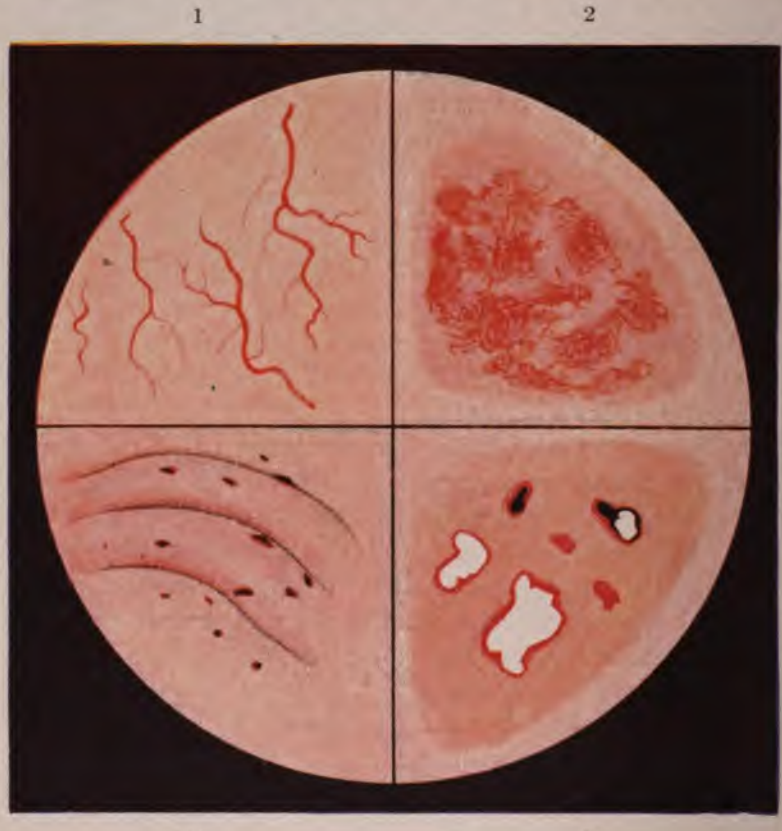


FIG. 331.—CYSTOSCOPIC PICTURES IN VESICAL CATARRH. 1. Increase of the vascular trunks in chronic cystitis. 2. Marbling of the mucous membrane in capillary hyperemia with irregular distribution. 3. Swelling of the mucous membrane, with ulcers and hemorrhages in chronic cystitis. 4. Flat ulcerations covered with mucus and incrustations. (After Zangemeister.)

vascular trees or as a network. The intervening portions of the mucous membrane may retain their normal yellowish-white color if the capillaries are not involved (Fig. 331_1); if the capillaries are also engorged, the mucous membrane presents a diffuse redness, ranging from pale red to scarlet or brownish-red; the variations of color give the mucous membrane a marbled appearance (Fig. 331_2). Diffuse redness may completely obscure the larger ectatic blood-vessels. (It should be noted that the degree of vascular injection can be correctly determined only if the prism is clean and the light very intense.) Hyperemia

produces a peculiar glistening appearance of the mucous membrane, which is particularly well seen in recent conditions; later the superficial layer of epithelium desquamates and the mucous membrane appears velvety and lustreless.

Swelling of the mucous membrane is almost always present. In recent severe catarrh of the bladder the mucous membrane is edematous and easily thrown into folds; in chronic conditions signs of hypertrophy are more prominent. The membrane is greatly thickened and forms large folds; even the larger vessels can barely be seen underneath (Fig. 331_3). The entire bladder wall, or only circumscribed portions, may be swollen; most frequently the floor and the region of the ureteral orifices share in the hypertrophy.

FIG. 332.—CYSTOSCOPIC PICTURE IN CYSTITIS TRIGONI. The mucous membrane shows erosions (red) and scaly shreds floating in the irrigation water with a precipitate of mucus (white). The neck of the bladder is swollen and covered with adherent mucus (modified after Zangemeister).

FIG. 333.—TUBERCLES ON THE VESICAL MUCOUS MEMBRANE, usually situated at the bifurcation of the blood-vessels (modified after Zangemeister).

Ecchymoses are frequently associated with severe hyperemia and appear as small hemorrhagic points, usually situated along the top of the folds (Fig. 331_3). The mucous membrane bleeds at the slightest touch with the cystoscope.

Ulcerations are quite frequent, particularly on the floor of the bladder, and are recognized as differences in level, often with sharp borders and covered with secretions or whitish masses which represent incrustations of precipitated salts (Fig. 331_4).

The secretion is seen adherent to the wall in large or small shreds (Fig. 332), or it covers the wall in the form of small white dots, or floats in the irrigation water after separating from the mucous membrane. It may be so abundant that cystoscopy is practically impossible in spite of careful irrigation of the bladder; while in certain forms of catarrh it is so scanty as to be barely seen.

It is important to determine by means of the cystoscope the variety of vesical catarrh present. Acute cystitis is characterized by marked vascular injection and an increase in the number of visible blood-vessels, or by diffuse hyperemia. The mucous membrane is shiny, somewhat edematous, and presents erosions and ulcerations with hemorrhages in and on the free mucous membrane. The secretion is abundant.

In chronic cystitis diffuse hyperemia is more rare; the mucous membrane is usually pale pink in color or even grayish-white, lustreless, and so thick that the vessels cannot be seen through it; swelling is very marked and leads to the production of folds. Hemorrhages are much more rare.

The cystoscopic picture of gonorrheal cystitis is not characteristic. The above-described changes characteristic of acute and chronic processes are seen. The localization of the lesions at the neck of the bladder is characteristic, and in the form of chronic cystitis of the neck of the bladder, it frequently represents the last and only sign of former infection of the bladder wall. The trigonum in these cases is greatly injected, and the mucous membrane is swollen and covered with mucus. Punctate hemorrhages are often scattered over the mucous membrane.

Tuberculous cystitis is a cystitis accompanied by tuberculous infection of the bladder; but the cystitis is by no means a constant phenomenon, and tuberculosis of the bladder without cystitis is very frequently observed. The associated cystitis is not characteristic and presents the same pictures as those described above; on the other hand, tuberculosis of the bladder often produces such definite changes that the diagnosis can be made by the cystoscopic picture alone. This consists in tubercles, which appear as grayish-white or reddish nodules as large as a hemp-seed and often surrounded by a red areola; they are found frequently at the bifurcation of the blood-vessels, and particularly at the trigonum and fundus and, in descending renal tuberculosis, around the ureteral orifices. As the tubercles degenerate, ulcerations are formed which are not characteristic and can be recognized as tuberculous only by their immediate proximity to tuberculous nodules. When a descending renal tuberculosis reaches the bladder, the orifice of the diseased ureter appears rough and ragged, with irregular, notched edges surrounded by recent tubercles. (In every case of tuberculosis of the bladder the kidneys must also be examined for tuberculosis, see page 591.)

A rare cause of frequent micturition, usually with pain, is found in **contraction of the bladder** (Schrumpfblase), or hypertrophy of the bladder wall with contraction of the lumen, which usually follows chronic catarrh. The desire to urinate is increased in inverse

proportion to the capacity of the bladder. The diagnosis of this condition is made by filling the bladder; if the desire to urinate occurs regularly when the organ is only moderately distended, say with 80 to 100 c.c. of fluid, and the urine escapes along the side of the catheter, the capacity of the bladder is less than normal. Acute catarrh and severe irritation of the bladder must be excluded; sometimes the thickened wall of the bladder can be directly felt.

Contracted Bladder.

Other causes of painful tenesmus are **tumors, calculi,** and **foreign bodies** in the bladder; but as they also produce other symptoms and require a different diagnostic method, they are not included in the present analytical diagnosis and will be discussed in a separate section at the end of this chapter.

There is no doubt that the cause of dysuria is most frequently found in diseases of the urinary apparatus itself, and since the employment of the more delicate methods of examination, particularly the centrifuge and the cystoscope, the number of cases in which the bladder and urethra are found entirely normal in the presence of well-marked dysuria has become greatly reduced; nevertheless some cases remain in which the cause of the dysuria must be sought elsewhere, chiefly in **certain diseases of the genital organs.** The manner in which the symptom is produced in these diseases is variable. Some lead to diminution in the size of the true pelvis and pressure on the bladder, or displacement of the bladder with distention of the sensitive floor of the organ. Such conditions are pregnancy, myomata, retroflexion of the uterus, especially of the gravid uterus, tumors of the adnexa, anteversion and anteflexion, anteposition, retro-uterine hematocele, and abscess in Douglas' space. Another class of diseases produce frequent micturition reflexly, particularly vulvitis, colpitis and other diseases of the mucous membranes. Inflammations in the neighborhood of the bladder, such as metritis, perimetritis and parametritis, exudates and pyosalpinx produce urinary symptoms because the bladder takes part in the hyperemia of the pelvic organs, or because the sensitiveness of the vesical mucous membrane is increased, although no local changes are present. Any one of these conditions may be the cause of frequent micturition, but only if the urinary organs themselves are found to be healthy. Dysuria due to disease of the bladder and urethra is attended by pain, which is usually absent in genital diseases, with the exception of vulvitis, when the inflamed areas are irritated by the urine, and perimetritis, in which the serous covering of the bladder is involved in the inflammation.

Tenesmus in Diseases of the Genital Organs.

If careful examination of all the adjacent structures fails to reveal anything abnormal, the tenesmus must be explained as a **local neurosis.**

Cases of this kind undoubtedly occur, although since the introduction of cystoscopy the number of cases of so-called irritable bladder has been very much reduced, and the diagnosis is nowadays admissible only when neither the bladder nor the genitalia can be regarded as the cause of the tenesmus. Medical treatment is required only if the constant desire to urinate becomes troublesome or interferes with the patient's occupation or general health. As a rule the patients are hypersensitive, hysterical individuals. The diagnosis is made entirely by exclusion.

Vesical Neurosis.

Diagnosis of the Causes of Incontinence.

Definition. Incontinence, or the involuntary evacuation of urine, is a condition in which there is a constant or periodic discharge of urine not accompanied by the sensation of a physiologic desire to urinate. A very different condition is meant by the patient when she says that she cannot hold her urine, and consists in an intense tenesmus with a constant dribbling of urine. The latter form of involuntary urination is due merely to the fact that the patient is unable to suppress the desire to urinate long enough to reach the closet. The changes to which it is due are of an entirely different nature and belong to dysuria. Before making a diagnosis of incontinence it is therefore wise to exclude this condition by inquiring carefully into the history.

The diagnosis of incontinence itself is easy. Eczema and furuncles are often seen in the neighborhood of the genitalia, there is a urinous odor, and a discharge of urine. There are, of course, differences, depending on the nature and intensity of the disease which causes the involuntary urination. In the severest cases the patients cannot hold a single drop, and the urine flows constantly while they are standing up or lying down. In less severe cases there is complete continence in the horizontal position; or the woman is at least able to hold the urine for a long time, but loses it as soon as she stands up. In still milder cases continence is preserved in the erect posture, and the involuntary discharge occurs only after sudden exertion, after abdominal pressure—as during coughing or sneeezing—or during active exercise.

Diagnosis of Incontinence.

The physician's most important duty is to discover the causes of the incontinence, which may reside in two entirely different conditions, either in fistula and injuries of the urinary apparatus, or in insufficiency of the closing apparatus of the bladder.

The distinction between these two conditions, as well as the diagnosis of incontinence itself, can usually be made in the following manner: The patient is placed on the examining chair, and the source of the

urine, whether in the urethra or in the vagina, is determined by inspection. This is the most important point to settle; for if the urine flows from the vagina, there must be an abnormal communication between the urinary and the genital apparatus (fistula), while the discharge from the normal channel merely indicates insufficiency of the sphincters which control the urethra.

A **fistula** may be felt with the finger if it is situated in the vagina and has attained a certain size, and it may be possible to introduce the finger into the bladder and to feel defects in the vesicovaginal septum if they are large. If the fistulous opening is small or hidden among the folds of mucous membrane, it is more easily found with a Simon speculum. As soon as the entire anterior bladder wall is exposed in the speculum, the urine is seen to flow and collect in the speculum. By carefully noting the direction from which the urine appears to come, the small fistula is discovered and may be exposed by separating the mucous membrane with hooks and tenaculum, so as to bring the fistulous opening and the flow of urine into the field of vision. If there is any doubt whether the opening is really a fistula or the external os, or only an apparent opening, a catheter may be introduced into the bladder and brought out again through the supposed fistula; or, if this fails, the catheter is allowed to remain in the bladder, and a sound introduced into the fistula, and the two brought into direct contact. If it is found impossible either to expose the fistula or to see the discharge of urine directly, the so-called milk test is employed. An irrigator is filled with about a litre of warm milk and the tube attached to a catheter. After the anterior vaginal wall and the external os have been exposed in a Simon speculum, the catheter is introduced into the bladder while the lower opening is held shut, the vagina is wiped dry, and the milk allowed to flow. If the fistula is large, the milk appears at once; if the fistula is small, the first portion of the milk introduced often fills the bladder and, as the speculum is displaced or the folds of mucous membrane are separated with hooks, the milk suddenly makes its appearance. Sometimes, when the bladder is very much distended, the milk flows out again through the urethra and runs into the vagina, and under these circumstances it may appear to come from a fistulous opening, whereas the only condition present is incontinence of the urethra. The milk test is a very reliable method of diagnosticating incontinence, and at the same time of detecting a fistula and determining its nature.

Diagnosis of Fistula.

If the presence of an abnormal communication has thus been recognized, it remains to be determined where the fistula begins in the urinary apparatus and in what portion of the genital apparatus it terminates. A fistula may begin in the bladder or ureter and end in the vagina or uterus.

Occasionally urethrovaginal fistulæ are also seen; but they have no special significance because a small communication between the anterior half of the urethra and the vagina merely causes a slight change in the stream during urination and does not produce incontinence; a fistula in the posterior half, on the other hand, usually extends to the bladder; or, since it is always associated with the destruction of the closing apparatus of the bladder, produces the same kind of incontinence as a vesical fistula.

The seat of the fistula may in itself decide whether it is a vesical or a ureteral fistula. The latter are usually situated to one side in the vaginal vault and rarely open into the cervix; while vesical fistulæ are almost always situated in the anterior wall. A positive distinction can be made by means of the milk test. In vesical fistula

Fig. 334.—Cystoscopic Picture in a Case of Traumatic Fistula in the Trigonum. The posterior portion of the fistula is healed. (Modified after Zangemeister.)

the milk always returns; although, if the opening is small, it may be necessary to separate the edges with hooks. In ureteral fistula the injected milk does not return but fills the bladder itself, while clear urine often drips from the fistula at the same time. The character of the fistula can be determined in most cases by sounding. If a catheter is introduced into the bladder and the fistula sounded through the vagina, the two instruments touch one another; whereas in the case of a ureteral fistula a small sound passes backward and upward a considerable distance without touching the catheter in the bladder. The next step is to determine whether the vesical fistula opens into the vagina (vesicovaginal fistula), or into the cervical canal with or without loss of part of the anterior lip (vesico-uterine fistula). In simple cases the opening of the fistula underneath the vaginal portion in the anterior vaginal wall can be discovered with the finger; or on inspection with a speculum the entire vaginal wall may be found entirely normal, and the urine seen to escape from the external os. In more difficult cases the point must be decided by the milk test. The cervix

Vesical, or Ureteral Fistula.

is plugged with a firm tampon and the milk introduced into the bladder. If it returns, the fistula must open in the vagina; if not, the opening is in the cervix. It is difficult to see the fistula directly within the cervix if the latter is well formed and the external os is not much dilated. But if part of the anterior lip is destroyed, it is much easier to see the fistula and, if necessary, to introduce the sound. Incision of the cervix for diagnostic purposes is not necessary. In the case of ureteral fistula the exact seat of the opening is more difficult to determine because the milk test cannot be employed. If the opening is in the vaginal vault it can easily be seen and sounded (*ureterovaginal fistula*); but if the ureter opens into the cervix—*uretero-uterine fistula*—the diagnosis can only be made by positively excluding a vesico-uterine fistula; or, in other words, by repeatedly obtaining negative results with the milk test, when there is no doubt that the flow of urine is from the uterus. In cases of this kind, when it is important to demonstrate that the fluid coming from the uterus is urine, the secretion must be colored by injecting a solution of indigo carmine under the skin. After the diagnosis of fistula has been positively established, it may be necessary, if an operation is contemplated, to examine for cicatricial changes and adhesions in the edges of the fistula.

Cystoscopy may afford information in regard to the existence, position, and occasionally also the cause of a vesical fistula; or, what is still more important, the topographical relations of the ureteral orifices to the edge of the fistula. For the diagnosis of ureteral fistula cystoscopy is superior to all other methods. Incontinence is an obstacle to its employment in the case of vesical fistula. As the bladder must contain at least from 100 to 150 c.c. of fluid, cystoscopy is necessarily restricted to cases of small fistulæ, or cases in which the patient can control the bladder sufficiently in the recumbent position. As a rule the fistula has to be closed temporarily by packing the vagina with a tampon or the colpeurynter, or by pinching the vaginal walls or the lips of the external os together over the fistula with forceps.—In cases of large fistulæ cystoscopy is out of the question.

Cystoscopy in the Diagnosis of Fistulæ.

A vesical fistula is recognized as a black hole in the bladder (owing to the absence of illumination) surrounded by smooth or thickened mucous membrane, usually exhibiting cystitic changes; quite often the fistula is continuous with a scar (Fig. 334). A careful search is necessary when the fistula is small. Occasionally it is completely hidden between the folds of mucous membrane and cannot be discovered at all. Under such circumstances cystoscopy may fail.

Case 31. A woman with partial incontinence following the first delivery has a small vesicovaginal fistula distinctly visible in the vagina. Although the tip of a small sound could

be introduced into the fistula, I was unable to find the opening in the bladder, even after a long search with the cystoscope; but finally discovered it hidden among the folds of the mucous membrane after I had marked the place by introducing a matchstick through the vagina.

The ureteral orifice is seen at the edge of the fistula or at some distance from it. If it is hidden among the folds of mucous membrane it may be found more easily by means of chromocystoscopy; if both ureters are found to functionate normally, a ureteral fistula is excluded. Cystoscopy in the form of chromocystoscopy finds its greatest field of usefulness in the diagnosis of ureteral fistula. If the stream of urine is absent on one side, the presence of a (ureteral) fistula may be assumed when there is involuntary discharge of urine through the vagina, and vesical fistula has been positively excluded. In doubtful cases the diagnosis may be confirmed by introducing a ureteral catheter into the corresponding ureter; the catheter will not pass beyond the solution of continuity in the ureter and, if it is allowed to remain in place, the absence of urinary secretion on that side can thus be demonstrated. The catheter must be introduced very carefully in order to avoid perforating the scar tissue with the point. By carefully observing the ureteral orifice in cases of ureteral fistula it is sometimes possible to find out whether the ureter is entirely divided or merely contains a lateral opening. In the former case the contraction-wave which descends along the ureter is interrupted at the point of division, and the contractions at the ureteral orifice are abolished—"the ureter lies dead." If the ureter is only partially opened, the contraction-wave still descends but the urine is not projected into the bladder, because it flows out through the fistula; in that case, contractions are seen at the ureteral orifice without the discharge of urine—"the ureter goes empty." In the following case cystoscopy stood me in very good stead:

Case 32. During my service in Berlin I undertook a double oöphorectomy. Two weeks later, after a fever of several days' duration, the laparotomy-scar reopened and discharged at first pus, and then a serous, turbid fluid with a urinous odor. Division of a urachus was excluded because the vertex of the bladder on cystoscopic examination was found to be normal. As the milk test was also negative, the possibility of a fistula from the ureter to the abdominal walls suggested itself. I made another cystoscopic examination and found that the function of the left ureter was normal, while on the right side there were contractions at the ureteral orifice without the discharge of urine (empty ureter). I accordingly diagnosticated partial division of the right ureter and, to confirm the diagnosis, introduced ureteral catheters on both sides. On the left a normal quantity of urine was discharged, but not a drop on the right.

The other cause of incontinence is insufficiency of the closing apparatus of the urethra. This condition may be surmised if the patient complains merely of occasional dribbling of urine, especially during abdominal pressure (cough, etc.) or when the legs are widely separated as in taking long strides, and the discharge of urine is not

constant. On examination the diagnosis is confirmed by seeing the flow of urine from the urethra. If the patient is made to cough and bear down, the urine usually begins to dribble or is projected in a stream. If this does not occur, the diagnosis of insufficiency of the closing apparatus is made by excluding the presence of a fistula with the milk test. The cause of the insufficiency is more difficult to discover. As a rule it is found in paresis or paralysis of the sphincter muscle, following chronic vesical catarrh due to traumatism (parturition), or in nervous persons; quite often no cause for the paralysis can be discovered. In other cases there may be traumatic or ulcerative destruction of the urethra. In traumatic conditions the edge of the scar is smooth; while ulcers, which are often syphilitic, are surrounded by extensive callous thickening and other ulcerations in the neighborhood. Ulcers in the anterior half of the urethra do not cause incontinence; but if the posterior half, or even the muscle bundle of the sphincter muscle is also involved, the urine cannot be controlled. From one-third to one-half of the posterior urethra is necessary for normal bladder control. Nocturnal enuresis belongs to this variety of incontinence and must also be ascribed to paresis of the closing apparatus. It may be easily recognized from the patient's statements. A rare cause of incontinence is found in congenital malformations, such as division (hypospadias or epispadias) and complete absence of the urethra, vesical fistula or urachus fistula. These conditions, so far as they are observed in the living subject at all, are usually discovered in earliest youth, or else the history clearly indicates their congenital origin. The diagnosis is easy and depends merely on a proper understanding of the topography. On the other hand, conditions in which the ureteral orifices are abnormally placed, particularly in the vulva, are very difficult to recognize.

Case 33. Anna G. states that she is supposed to have been unable to control her urine since birth, but maintains that she is able to urinate in the normal manner. The urethra is normal, the introitus partly closed by the hymen; to the right of the hymen is found the opening of a wide mucous canal which can be followed about 2 cm. with a sound and does not communicate with the urethra or vagina; sounds introduced into the three canals at the same time do not come in contact with one another. There is involuntary but periodic discharge of the urine, which evidently comes from the abnormal canal on the right side. The milk test is negative; not a drop of milk returns either from the vagina or from the urethra. The urine is clear; the capacity of the bladder is about 200 c.c. On cystoscopic examination a normal ureteral opening is found on the left side, with an intermittent flow of urine; while on the right no ureteral orifice can be seen.

Diagnosis of the Causes of Ischuria.

Definition. Ischuria signifies difficult urination, or inability to urinate. In mild cases the evacuation of urine is merely delayed and the act must be assisted by straining and bearing down; in other

cases the patient is able to urinate only in certain attitudes, or drop by drop; in severe cases there is complete retention and the bladder becomes distended. The involuntary escape of urine from an excessively distended bladder is called paradoxical ischuria (incontinence with retention.)

The diagnosis is based in the main on the above statements obtained from the patient, but the presence of an excessively distended bladder, especially with complete retention, is also confirmatory. The diagnosis is most likely to be missed when there is dribbling of urine, because the fact that the urine escapes seems to exclude the possibility of ischuria. In doubtful cases the diagnosis is decided by the catheter. In a special form of ischuria the patient fails to empty her bladder completely and retains a certain amount of residual urine; cases of this kind are best explained by assuming insufficiency of the accelerator urinæ. It is recognized by introducing the catheter after urination and drawing off the residual urine; the quantity of the latter will serve to indicate the degree of ischuria present.

Diagnosis of Ischuria.

While the diagnosis of ischuria may in general be regarded as easy, considerable difficulties arise in discovering the causes of the condition. Yet this question must be decided in every case, because ischuria is often a permanent trouble that disappears only with the removal of the cause. I shall subdivide ischuria into a mechanical form, in which the inability to evacuate the urine is due to a mechanical obstacle; and a functional form, which is due to a nervous disturbance of the mechanism of urination.

Causes.

The diagnosis of mechanical ischuria is made by finding a mechanical obstacle to the evacuation of urine. The mechanism may be intact or may also be involved. Diseases of the urethra, such as stricture, periurethral carcinoma and syphilitic scars, frequently produce difficulty in urination, but rarely complete ischuria. The diagnosis is readily made by introducing a catheter or a thin sound; but it must be remembered that it is possible to discharge the urine through a very much contracted canal. Conditions within the bladder are less frequent causes of ischuria in females; they consist in sudden closure of the internal urethral orifice by calculi, tumors, foreign bodies, or blood clots. Diseases of the genitalia are much more important in women and produce ischuria either by directly compressing the urethra against the symphysis, or by displacing and distorting the posterior urethra along with the floor of the bladder. In the latter form ischuria is one of the most important, as well as usually the first symptom of incarceration. Among the tumors that produce ischuria are submucous myomata that have been extruded into the vagina, large carcinomata of the vagina, hemato-

Mechanical Ischuria.

colpos, myomata and large carcinomata of the cervix, retroflexion of a gravid uterus in the third or fourth month, retro-uterine hematocele, large exudates in Douglas' space, retro-uterine ovarian tumors, and pelvic tumors. These conditions are as a rule easily recognized because the tumors are always large and fill the entire pelvis. The diagnosis of a mechanical cause of ischuria is often missed because no examination is made, and the symptoms in women are attributed offhand to hysterical paralysis of the bladder. This is a grave error because the mechanical obstacle is not removed, and the constant catheterization, especially when performed by the patients themselves, may produce severe cystitis and pyelitis. In every case of ischuria a bimanual examination must be made at once in order to search for the local cause.

Ischuria is *functional* when it is due to a nervous disturbance of the mechanism of urination. In order to understand how this nervous influence may act it must be remembered that under normal conditions the impulse to urinate is conveyed along the sensory nerve paths from the inner surface, and especially the neck of the bladder. This is immediately followed by reflex relaxation of the sphincter muscle, after which the bladder is emptied by means of abdominal pressure, the accelerator urinæ being employed, if at all, for evacuating the last remaining drops of urine. It is evident, therefore, that functional ischuria may be due to disturbances of reflex activity, or to the inability to allow abdominal pressure to act with sufficient force. Reflex disturbance may affect either the sensory path which conveys the impression of a full bladder to the central organ, or the centrifugal path which effects relaxation of the closing apparatus. These two processes cannot be considered separately, except when there is a disturbance of conduction in the peripheral nerves; in most of the cases the mechanism must be taken as a whole.

Functional Ischuria.

The *diagnosis* of functional ischuria is made by excluding all possible mechanical causes; for if no obstacle to the evacuation of urine can be found anywhere, nothing is left but some disturbance in the nervous apparatus. The diagnosis is therefore in the main easy; but in the attempt to determine the nature of the functional disturbance and what particular portion of the nerves and nerve-centres concerned in the mechanism is affected—whether the disturbance is peripheral or central, whether it is based on organic changes in the nervous apparatus, or purely functional—great difficulties are encountered. Paralysis following a severe vesical catarrh and probably due to some alteration of the nerve fibres in the bladder wall must be regarded as peripheral. Ischuria due to changes in the central organs is, however, more frequent. Organic disease of the spinal cord may destroy the reflex apparatus and interfere with active abdominal pressure; in acute

febrile diseases with coma ischuria occurs because the desire to urinate is not perceived and the sphincter cannot be relaxed. Hysterical persons have ischuria because they lose control over the sphincter. Ischuria following operations on the vulva and vagina is due to disturbances of reflex action, and ischuria after laparotomy and during the puerperium is often due to the inability of the patient to exert abdominal pressure in the horizontal position. Ischuria following operations in which the peritoneum has been stripped from a large portion of the bladder is also explained by injury of the bladder nerves.

Spastic conditions of the sphincter muscle, interfering with relaxation, constitute a rarer form of ischuria. In several cases I was able to make the diagnosis of this condition by noting that the slightest irritation of the neck of the bladder with the catheter produced violent contractions of the sphincter muscle, which closed down firmly on the catheter. This form of ischuria frequently follows catarrhal conditions of the mucous membrane in the region of the neck of the bladder.

Tumors of the Bladder.

The first suspicion of tumor of the bladder is aroused by hemorrhage. The tumor bleeds without any special cause; the blood becomes mixed with urine and gives it a more or less bloody color; rarely pure blood is discharged. The hematuria is intermittent. As blood from the vagina may also cause bloody urine, catheterization is the only method of determining that the blood is derived from the urinary apparatus. While hematuria is not pathognomonic of tumors, since it occurs also with calculi, foreign bodies and ulceration, it is nevertheless more abundant in tumors than in any other condition. Other symptoms have no diagnostic significance and may be entirely absent if the tumor does not happen to be situated at the trigonum.

Microscopic examination of the urine may reveal large pieces of tissue with the structure characteristic of neoplasm which are strongly suggestive of tumor of the bladder; but the diagnosis of neoplasm can never be made by a few separate cells.

Combined examination of the bladder through the vagina and abdominal walls is very uncertain. Small soft tumors may not be palpable or may escape the palpating finger. If the tumor is hard and firmly seated in the wall of the bladder, it may be felt and located in the bladder if the abdominal walls are soft. If the bladder wall and its surroundings are infiltrated with carcinoma, palpation is quite easy. Exploration of the bladder with the finger is, however, a much more certain method, the size, seat and consistency of the tumor, the presence of ulcerations on the surface and, above all, the size of the pedicle and the condition of the surrounding wall are easily recognized,

and important diagnostic and prognostic information is thus obtained. The procedure, however, necessitates dilatation of the urethra, which is not without danger, particularly if the tumor is necrotic, and may cause infection of the tumor itself or bring on hemorrhage by wounding its surface. For the same reason examination with the sound and catheter is not to be advised. Exploration of the bladder has been superseded by cystoscopy and is employed only when the results of the latter method are uncertain.

Even cystoscopy has to contend with technical difficulties in cases of tumor of the bladder, and the results are not infrequently quite misleading. The technical difficulties consist in the accompanying catarrh, the occurrence of hemorrhage when the instrument comes in contact with the diseased parts, and the interference with the movements of the cystoscope. Cystoscopic diagnosis consists in the main in the demonstration of a polypoid body projecting into the lumen of the bladder. This will not be difficult in the case of small tumors, as the entire tumor and the adjoining parts of the bladder wall can be brought into view at once. It is much more difficult when the tumor is so large that only half of it is brought into the field of vision; in that case the cystoscope must be moved about to obtain a view of the edge of the tumor and to determine its attachment to the bladder wall by means of the deep shadows which it throws. A circumscribed tumor clearly outlined against the normal surrounding wall is very apt to give the impression of a projecting tumor. Extravesical tumors, such as cervical myomata which invaginate the bladder wall, may produce a similar picture, but the bulging is usually less pedunculated and the investing membrane looks perfectly normal; whereas the surface of a vesical tumor is usually nodular, ulcerated, incrusted and covered with mucus and blood. The diagnosis by means of cystoscopy is much more difficult in the case of broad, sessile tumors, which may be mistaken for membranous and edematous swellings of the mucous membrane, especially if the surface is not ulcerated. Blood clots, collections of pus and abscesses may also be mistaken for tumors. In cases of this kind the diagnosis must be cleared up by repeated examination or by exploring the bladder.

By means of cystoscopy we must further determine the nature of the tumor. Benign papillomata and carcinomata are the only ones that have any practical importance. Papillomata appear as branching, papillary trees, either solitary or, more frequently, arranged in dense masses, with their tops floating in the fluid; under favorable illumination the blood-vessels can be seen through the mucous membrane. The surface rarely appears bright red, as it is usually covered with mucus or incrustations; ulcerations and hemorrhages are not

infrequently seen. The proliferation as a whole projects into the bladder and often throws a distinct shadow. Carcinoma produces a variety of pictures. In some cases it looks like a papilloma and cannot be distinguished with the cystoscope from the above-described benign forms. In other cases the cancer forms a circumscribed tumor with a fairly well preserved surface, and breakdown occurs late. Others again lead to infiltration of large portions of the wall and produce a flat prominence with a deeply ulcerated surface, covered with secretion and incrustations.

To illustrate the method pursued in making a diagnosis of tumor of the bladder, I cite the two following cases, which were observed in my service:

Case 34. Miss S., 33 years old. Tenesmus for the past five to six years; hematuria at intervals for the past eight months and almost constantly during the past three to four months; occasionally pain during urination; no disturbance of the general health.

Fig. 335.—Cystoscopic Picture of a Papilloma of the Bladder. (Modified after Zangemeister.)

Fig 336.—Cystoscopic Picture of a Carcinoma of the Bladder. (Modified after Zangemeister.)

Combined examination reveals a soft tumor in the anterior vaginal vault. The parts surrounding the bladder are free.

Cystoscopic findings: Color and injection of the vesical mucous membrane normal. Immediately behind the sphincter on the anterior wall there is a hemispherical tumor; the surface is irregularly nodular and covered with edematous, grayish-red, somewhat translucent mucous membrane covered with floating cysts; in places white precipitates of salt are seen. Immediately behind and to the right of this tumor is another about the size of a pigeon's egg, while a third tumor covers the entire trigonum. The surface of the anterior tumor is covered with villous, papillomatous excrescences, some of which are dendritic. The villi float in the fluid and contain a blood-vessel.

Diagnosis: Papillomata of the bladder (Fig. 335). Suprapubic operation confirms the diagnosis.

Case 35. Miss H. for the past six months has had tenesmus and burning during urination; for the past four months bloody urine, and once a severe hemorrhage, the symptoms having increased recently; emaciation and loss of strength began six or eight months ago. Combined examination reveals in front of the uterus a somewhat movable tumor about as large as an egg, of approximately oval shape and hard consistency; the tumor has no connection with the uterus or adnexa. Sounding and exploration of the bladder were not employed.

Cystoscopic findings: The roof, right wall, and floor of the bladder show normal mucous membrane; the right ureter is normal. On the left side a roundish tumor projects

into the bladder; the surface is fairly smooth, consisting of whitish, mortified tissue with incrustation; the base of the tumor is circumscribed and slightly polypoid, judging from the distinct, sharply outlined shadow thrown by the tumor (Fig. 336).

Diagnosis: Vesical tumor.

A suprapubic operation confirms the above findings and the microscope shows epithelioma.

Vesical Calculi.

Vesical calculi do not produce characteristic symptoms in the female, and their presence is obscured for a long time by the picture of the catarrh which they produce. Sometimes they are discovered by a lucky accident, or they may be revealed by cystoscopy performed for the purpose of investigating the changes produced by the long-continued catarrh and determining the cause. It should be a rule in every case of severe and protracted catarrh associated with intense pain to examine for calculus.

As in the case of tumors, the results of combined examination of the bladder through the vagina and abdominal walls are very unsatisfactory. In the first place, a calculus of moderate size may escape palpation altogether, particularly if it is surrounded by a thickened bladder wall. In ten cases occurring in my service I failed to diagnose calculus in this way, and three times I was unable to feel calculi larger than a hazel nut, the presence of which had been demonstrated by other means. In addition, calculi may be mistaken for other tumors, and even more frequently the diagnosis of calculus may be made when nothing is present.

Fritsch describes a mistake of this kind in the following words:

"A woman had had many bladder symptoms; she had certainly had gonorrhea and frequent attacks of cystitis. On examination I distinctly felt a stone in the bladder which could be displaced from right to left in a manner absolutely characteristic of calculus. I felt so sure of my diagnosis that I did not even examine with a metal catheter. The woman was anesthetized for the purpose of extracting the calculus through the dilated urethra. While she was under anesthesia the introduction of the metal catheter showed that the bladder was empty. The bladder was then held to one side, and this showed that the tumor was situated outside of the viscus; later, under the administration of powerful laxatives, the tumor turned out to be a coprolith."

Examination of the bladder with a catheter or calculus-sound yields much more reliable results. Not infrequently the calculus is recognized when the catheter is introduced for the purpose of withdrawing urine. This is mere luck, however, and occurs only when the stone happens to be on the floor of the bladder; often it is hidden in a pouch of the lateral wall and cannot be reached with a sound. With the finger, on the other hand, a stone can always be detected, unless it is hidden in a diverticulum and covered with proliferated mucous membrane. Still more valuable is the information obtained with the finger in regard to the size of the stone, its position, shape and degree

of mobility. With regard to the size, the cystoscope may be very deceptive. For this reason, palpation of the stone with the finger is of great value, particularly in the choice of operative methods. As the danger of infection is much less than in the case of tumors, and the urethra must in any event be dilated for the purpose of extraction, digital exploration may be used more freely than in the case of tumors. For diagnostic purposes alone, however, the method should not be employed until after cystoscopy has been performed.

Cystoscopy is the most reliable method for demonstrating the presence of stone. To be sure, the examiner often has to contend with great difficulties. The accompanying catarrh may be so intense that it is impossible to fill the bladder with clear fluid; incontinence is not infrequently present, making it impossible for the patient to retain the injected water; or the intense strangury may cause premature expulsion.

FIG. 337.—CYSTOSCOPIC PICTURE OF A PHOSPHATIC CALCULUS. (Modified after Zangemeister.)

FIG. 338.—URIC ACID CALCULUS IN THE BLADDER. (After Casper.)

FIG. 339.—CALCIUM OXALATE CALCULI IN THE BLADDER. (After Casper.)

Occasionally the calculus is so large, or situated so near the urethral orifice, that the cystoscope cannot pass it. But if all these difficulties can be overcome, the picture is usually so clear and beautiful that a single glance suffices for the diagnosis. The size, shape, surface, color, number and position of the calculi are extremely variable. All these points are easily recognized and require no special description. I refer to the cystoscopic pictures shown in Figs. 337, 338 and 339.

With the exception of the rarer cases in which the stone is encapsulated in a diverticulum, the calculus can always be found with the cystoscope; it is, however, impossible to effect an entrance into all the pockets contained in the bladder.

By means of radiography the presence of a calculus in the bladder can be determined, provided it does not happen to be hidden behind the bone; but as the results of cystoscopy are so certain, there is no need to resort to the X-rays unless the other method fails on account of the above-mentioned difficulties. Radiography, however, has one advantage over all other methods in that it easily and

without danger reveals the presence and position of metallic foreign bodies that form the nuclei of calculi (Fig. 340). The following figures from a monograph by Zangemeister based on material from my service shows the comparative value of the various methods for the diagnosis of calculus.

Among 12 cases of vesical calculi the stone was recognized but once by inspection (it projected from the urethra); once by direct palpation through a vesicovaginal fistula; five times with the sound or catheter; and five times it was found with the cystoscope alone.

FIG. 340.—SKIAGRAPH OF TWO VESICAL CALCULI lying side by side in the sagittal direction. The nucleus of one of them is formed by a hairpin. (Original.)

Foreign Bodies in the Bladder.

Foreign bodies in the bladder are very frequent in women, and either as foreign bodies or as the nuclei of vesical stones are of great practical importance. The foreign body either gets into the bladder from without, as in the case of ligatures; or is introduced for therapeutic purposes into the bladder and urethra and unintentionally allowed to remain, as in the case of pieces of catheter, the remains of urethral pencils made of wax, cocoa butter or paraffin; or foreign bodes, such as hairpins, leadpencils and the like, are introduced into the urethra for purposes of masturbation.

Occasionally the diagnosis of these foreign bodies is suggested by the patient's statements; but usually no positive information is obtained, because the patient either purposely conceals or does not know of the introduction of the foreign body. In such cases it may

remain in the bladder for a long time, until it finally produces symptoms, or a calculus forms around it and medical treatment is required.

I have removed four vesical calculi that had formed around foreign bodies; in two the nucleus was a hairpin; in one, a golden pencil; and in the fourth, a small piece of paraffin.

Cystoscopy is the surest and least dangerous method of diagnosis. After the bladder has been carefully irrigated, the foreign body is usually seen without difficulty. Hairpins, pieces of catheter, and irrigators are easily identified in this way.

In one case I had a great deal of difficulty in diagnosing a lot of round, dark-brown pellets which floated on the surface of the urine in the upper portion of the bladder and danced about at the slightest movement. After they had been flushed out they were found to be particles of cocoa butter. The patient had been treated some time previously with urethral pencils made of iodoform.

The X-rays give us very useful pictures in cases of metallic foreign bodies, either free or surrounded by vesical nuclei, particularly in regard to the position.

Seiffart demonstrated the presence of a hairpin in the bladder by means of the X-rays alone, and photographed it by introducing the plate into the vagina.

I myself found a hairpin which formed the nucleus of a vesical calculus and had it photographed (see page 585).

On account of the danger of infection and the necessity of dilating the urethra, exploration of the bladder with the sound and finger is a less valuable method of diagnosis.

Diseases of the Ureter.

The gynecologist is interested in ureteritis, ureteral fistulæ, and injuries and compression of the ureter.

Ureteritis is always secondary and follows either cystitis (ascending) or pyelitis (descending); hence in a case of cystitis or pyelitis the physician must determine whether the disease has spread to the ureter.

Ureteritis.

Disease of the ureter in itself has no great clinical significance. It should be diagnosticated, however, because the ureter forms the connection between the kidneys and the bladder, and if it is diseased, it therefore indicates that involvement of the kidney or bladder is imminent or has already occurred.

The diagnosis of ureteritis cannot be made by examining the urine, because cells derived from the ureter cannot be distinguished from the deep bladder cells and the cells that line the pelvis of the kidney. Occasionally the occurrence of drawing or colicky pain in the course of the ureter may indicate that the canal is involved; but in general the subjective symptoms are of little diagnostic value. Cystoscopy also fails in most cases. Although the cystoscope or the

ureteral catheter may serve to demonstrate that urine containing inflammatory morphologic elements escapes from the ureter, it is impossible to decide whether these elements are derived from the pelvis of the kidney or from the ureter exclusively. If the ureteral orifice and the portion immediately adjoining are diseased, the results of cystoscopy are somewhat more satisfactory, although it is usually impossible to see the mucous membrane itself. The thickness of the fold around the ureteral orifice is no criterion of infiltration of the wall, because the size of this fold is subject to great individual variations. The only thing that indicates disease of the ureter is circumscribed change in the mucous membrane surrounding the ureteral orifice; if this region is very much injected or covered with bullous edema, the ureter is probably diseased. Dilatation of the ureteral orifice due to ulceration is seen in descending tuberculosis and is a sign of value. A positive diagnosis of ureteritis can sometimes be made by direct palpation of the ureter, particularly that portion which joins the bladder. (For the technique see page 94.) A cord which may be as thick as a pencil is felt on one or both sides, passing in a flat curve with the concavity directed upward from the vaginal vault to the lateral wall of the pelvis; the cords are usually sensitive to pressure. The greater the infiltration, the greater will be the distance of the ureter from the median line.

Case 36. Pain in the region of the left kidney for two years; strangury with vesical spasm. The uterus lies somewhat forward. On the left side the ureter is distinctly felt as a cord the thickness of a pencil, running from the anterior vaginal vault to the pelvic wall; the infiltration ceases exactly at the point which corresponds to the ureteral orifice in the bladder. The ureter is moderately sensitive to pressure; the right ureter is merely somewhat thickened, and also distinctly felt in its course to the pelvic wall as a cord the thickness of a wooden knitting-needle. The median extremities of the two ureters are about 2 cm. apart; at this point soft bladder wall is felt.

Cystoscopy reveals a normal mucous membrane, except that the floor of the bladder is somewhat reddened; in the region of the left ureteral orifice there is seen bullous edema with transparent, closely packed vesicles, among which the left ureteral orifice is hidden; on the left side there is no flow of urine; on the right the urine is always clear.

Gonorrhea and tuberculosis are the only diseases of the ureter that have any practical importance; they can be recognized only by the general picture. Occasionally the ulcerous destruction of the ureteral orifice may point to tuberculosis. Schrader in one case succeeded in making a diagnosis of tuberculosis by completely emptying the bladder and expressing the ureter bimanually, when he found tubercle bacilli in the urine.

For the diagnosis of ureteral fistulae see page 576.

The diagnosis of injuries of the ureter, whether by ligation or division, has assumed great importance now that abdominal operations have become so extensive and frequently bring us into collision with the ureters.

Bilateral complete ligation of both ureters is followed by complete anuria and the appearance of uremic symptoms, which, however, sometimes do not develop until some days after the accident. If no urine is secreted during the second twenty-four hours after the operation, ligation of both ureters should be suspected, as even the severest degree of prostration after a protracted operation attended with great loss of blood and the use of a large quantity of chloroform rarely produces anuria lasting more than twenty-four hours. In view of the importance of making an early diagnosis of this fatal complication, the steps which are employed for establishing the diagnosis must not be delayed longer than about thirty-six hours, or until the first appearance of uremic symptoms. Cystoscopy alone, even in the form of chromocystoscopy, does not help us with the diagnosis; for, if urine escapes from the ureters at all, it will be found in the bladder with the catheter; and even the complete absence of the urinary stream from the ureteral orifice is not enough to exclude some profound functional disturbance. The introduction of a ureteral catheter is the only certain means of making the diagnosis, as the instrument is arrested at a definite point, indicating the presence of the obstruction. It must be remembered, however, that after an operation the ureter may be displaced and difficult to catheterize on that account, or there may be a complete kink in the canal. This is all that can be accomplished with the ureteral catheter, but at least it supplies the indication for immediate operative revision of the ureters.

Ligation of one ureter rarely produces uremic symptoms or any marked diminution in the quantity of urine. If the other kidney is sound it undertakes the function of its fellow, sometimes with a slight disturbance of the quantity of urine, and the general condition soon becomes normal again. The only subjective symptom that might arouse a suspicion of the accident is a sudden pain in the region of the corresponding kidney. For this reason, chromocystoscopy and catheterization of the ureter, which are necessary for confirming the diagnosis, are usually not performed, and in most cases the ligation is unexpectedly discovered at the autopsy; or, if the patient survives, remains undiscovered as long as she lives. In rare cases ligation of one ureter leads to hydronephrosis, which can be recognized by its characteristic signs (see page 593, *et seq.*) and demonstrated by means of cystoscopy. Occasionally the ligature divides the catheter, and the urine which escapes through the opening infiltrates the tissues; or, if it makes its way to the outside, produces the symptoms of ureteral fistula. If attention has been called to the possibility that one ureter may have been ligated, the fact can be confirmed with the cystoscope by finding the corresponding ureter absolutely 'dead' and impermeable to the ureteral catheter.

Operative division of the ureter is frequently discovered during operation, or immediately after, when the specimen is examined. If it is not recognized and there is no suspicion of the accident, the diagnosis is usually impossible; for, if the urine is discharged into the free abdominal cavity, there may be no reaction whatever if the urine is free from germs, and the wound runs an entirely aseptic course until the secretion of the kidney finally ceases. But the accident usually occurs during severe operations that do not run an aseptic course, so that peritonitis almost always develops at once and obscures the picture of division of the ureter. If the division is extraperitoneal, the tissues become infiltrated with urine and an abscess is formed; if it is divided in the vagina, the symptoms of ureteral fistula soon make their appearance.

Compression of the ureters may be caused by large, hard abdominal tumors, by a carcinoma growing around the ureter, or by cicatricial contraction of exudates. The diagnosis of the cause of compression is important in determining the question of its removal. The necessity of demonstrating the existence of compression is suggested by the occurrence of uremic symptoms in cases of bilateral compression, or when it is desired to determine the extent of a carcinoma which is to be removed. Incomplete compression does not produce distinct symptoms; but if the occlusion is complete, the absence of the urinary stream is discovered with chromocystoscopy, or the impermeability of the ureter by catheterization. These procedures are often rendered very difficult on account of the displacement of the floor of the bladder in the case of large tumors.

Diseases of the Kidneys.

Although diseases of the kindeys belong to internal medicine and surgery, the diagnosis of some kidney diseases must be discussed in this connection. They are pyelitis, on account of its direct connection with diseases of the bladder; tumors of the kidney, which are frequently apt to be mistaken for genital tumors; and movable kidney, which is a frequent concomitant of gynecologic diseases. The dividing line between gynecology and general surgery may be drawn at the ureter, allowing to the former ureteral fistula and operative injuries; but from the diagnostic standpoint the gynecologist cannot altogether ignore the kidney.

Diagnosis of Pyelitis. The form of pyelitis which is most frequently seen by the gynecologist is that which follows cystitis of gonorrheal or tuberculous origin, or which is the result of infection by other organisms (catheter cystitis). In acute cases it is usually not difficult to determine whether the inflammation in the bladder has extended to the pelvis of the kidney if the region of the kidney is very sensitive to pressure and there is high

Pyelitis.

fever, usually lasting from four to six days and recurring in similar attacks at intervals. In subacute and chronic cases the question is more difficult to solve. Attempts to discover diagnostic points in the urine have failed. The caudate epithelial cells which were formerly regarded as pathognomonic also occur in the bladder, and an acid reaction, which is said to be characteristic, is present also in gonorrheal and tuberculous catarrh of the bladder. The quantity of pus in the urine and the degree of alkalinity may be so variable in pyelitis that the finding of a large quantity of pus does not necessarily indicate involvement of the pelvis of the kidney. An abundant amount of albumin, with a small quantity of pus, in the urine is somewhat more suggestive. The symptoms, which consist in renal colic and lumbar pain, may suggest disease of the pelvis of the kidney; but the only way to make a positive diagnosis is by means of cystoscopy. In those cases in which pyelitis follows cystitis, the changes described on page 568 will be found in the bladder wall; when the ureteral orifice is carefully observed, turbid urine will be seen to escape in cases of purulent pyelitis. This turbid urine is at first easily distinguished from the clear injected water, until it finally becomes intimately mixed with it. In other cases, particularly if the secreting parenchyma has been destroyed, pure pus may be evacuated. The cystoscopic diagnosis is more difficult if the urine coming from the kidneys is only slightly turbid and contains so few morphologic elements that it cannot be clearly distinguished from the injected water; on the other hand, particles of the bladder wall suspended in the fluid may sometimes seem to be derived from the ureter. The urine must be obtained directly from the ureter in order to make a positive diagnosis. But the introduction of the catheter in the presence of cystitis requires great care and certain special precautions to avoid transmitting the infection to the ureter. The bladder must be cleansed as well as possible by prolonged irrigation with a disinfecting solution (Casper recommends oxycyanide of mercury 1:5000), and contact of the catheter with any flakes of pus that may be present must be avoided. Great care is necessary in introducing the catheter in order to avoid causing erosions, which easily become infected; and the instrument must not be pushed in more than about 5 to 10 cm. If these precautions are observed, the few bacteria that are introduced in spite of them usually do not set up an inflammation, because they are washed out again by the stream of urine. Casper recommends flushing out the ureter through the catheter with a few cubic centimeters of 1:1000 silver nitrate solution, and reports numerous cases in which the observance of these precautions enabled him to catheterize the ureters in the presence of a cystitis without causing infection. When special care is necessary, as for example in the case of tuberculosis

of the bladder, the urine segregator (Fig. 341) may be tried. The model designed by Luys is the best. It has the shape of a sharply curved male catheter and consists of three parts: two lateral gutters with a small opening in front, and a stop-cock behind for drainage, and between them a smooth, uniformly curved portion covered with a thin rubber tube which can be stretched out in the shape of a septum by means of cogs and chain worked from behind. The introduction of the instrument in females is exceedingly easy. The apparatus, consisting of three pieces, is introduced closed, and the septum opened by turning a screw. If the instrument is in the median line, and the floor of the bladder is pushed slightly forward toward the vagina, the bladder will be divided into two portions, in which the two halves of the double catheter will collect the urine separately from each ureter and conduct it into a glass tube attached to the instrument. One

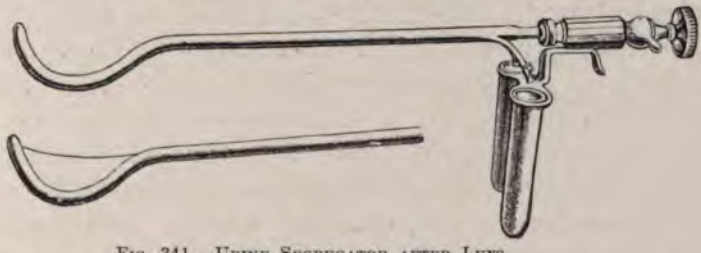


Fig. 341.—Urine Segregator after Luys.

cannot, however, be absolutely sure that the urine is obtained separately from the two ureters, although in most cases it is possible to do so. For this reason the segregator is inferior to catheterization of the ureters and should be employed only when the latter method is contraindicated.

After the ureteral catheter has been placed in position, the ureter should be allowed to contract a few times in order to flush out whatever may have gotten into the ureter from the bladder (Casper), after which a few cubic centimeters of urine are obtained for the purpose of examining the sediment (because if the catheter is allowed to remain too long, formed elements derived from the ureter may be added to the urine); and finally the quantity necessary for chemical examination is drawn off.

If cuboidal epithelial cells, pus corpuscles and blood in recognizable quantities are found in the sediment, and albumin is present in the filtered urine, a diagnosis of purulent pyelitis may be made.

The form of pyelitis is determined by the organisms which are found in the urine; tubercle bacilli should be looked for with special care.

It is impossible by any known diagnostic method to determine whether or not the renal tissue is also involved in the pyelitis; the most reliable sign is the quantity of albumin.

The following shows how cystoscopy and catheterization of the ureters, with other methods of examination, may lead to a diagnosis.

CASE 37. Mrs. G. The patient has been complaining for the past eight months of increased and somewhat painful micturition, with dragging pains in the region of the right ureter. The urine is very turbid and contains an abundance of pus. With the cystoscope the mucous membrane of the bladder is found to be normal; but from the right ureteral orifice, which is rigid and contracts sluggishly, large quantities of pus and tissue débris are discharged like the eruption from a crater; the urine coming from the left ureter appears to be clear. In order to obtain positive information in regard to the state of the left kidney, a Luys' segregator was introduced. On the right side the urine contained a quantity of pus large enough to fill half of a glass receptacle, while on the left, the urine was barely turbid, which could easily be attributed to pollution from the right side. An attempt was then made to palpate the ureters through the vagina, and on both sides, but particularly on the left, a distinctly thickened and painful ureter was found. The left side having thus been shown to be diseased, a catheter was introduced into the left ureter with the necessary precautions; the urine was slightly turbid and contained large numbers of epithelial cells from the pelvis of the kidney. In spite of the absence of tubercle bacilli the diagnosis of tuberculosis was made because the left lung was tuberculous.

Diagnosis of Renal Tumors. Definition. For the purpose of diagnosis the term 'renal tumors' may be made to include a number of morbid conditions of the kidney associated with distinct enlargement of the organ. Retention tumors owe their origin to the accumulation of urine containing mucus or pus (hydronephrosis and pyonephrosis). The neoplasms encountered are carcinoma and sarcoma. The gynecologist is interested in renal tumors because they are often mistaken for ovarian tumors, and in this connection it will be enough to discuss the diagnosis of renal tumors as such without going into the distinction of the different forms.

Diagnosis of Renal Tumors.

Some knowledge of the anatomy of the parts is necessary for a better understanding of the special properties of renal tumors. The posterior surface of the kidney is in relation with the quadratus lumborum and transversalis muscles, from the last thoracic to the first two or three lumbar vertebræ. Above, it extends to the twelfth rib and sometimes a little higher; the inferior pole often extends to the crest of the ilium. The left kidney is usually somewhat higher than the right. In the median line the kidney is bound by the psoas muscle. The organs are surrounded by soft, fatty tissue; the kidney is not covered by peritoneum, and the presence of a portion of peritoneum forming a kind of mesentery is pathologic. The large intestine is situated in front of, and a little to the outer side of the kidneys; the right hepatic flexure in front and to the right, and the descending colon in front of the left kidney. The ascending colon covers the lower pole of the kidney, follows the inner surface of the viscus to the level of the liver, and there forms a right angle and becomes the transverse colon. The splenic flexure is in relation with the upper pole of the left kidney, and from this point the descending colon descends alongside of the viscus. The relations between this portion of the large intestine and the peritoneum vary; but as a rule the posterior periphery

of the bowel, which is in contact with the side and upper pole of the kidney, is entirely extraperitoneal (Fig. 342).

The most important supports of the diagnosis are the position of the renal tumor and its relation to the large intestine. Small tumors produce practically no change in the position of an otherwise normal kidney; but as they increase in size they grow chiefly to the outer side and forward, because they are prevented from growing inward by the vertebral column. In doing so they separate the peritoneum from the lateral wall of the abdomen and push the reflection of the peritoneum, which is found in the anterior abdominal wall, farther forward. The tumor is always extraperitoneal at the posterior and lateral wall of the abdomen; as it continues to grow

Position of Renal Tumors.

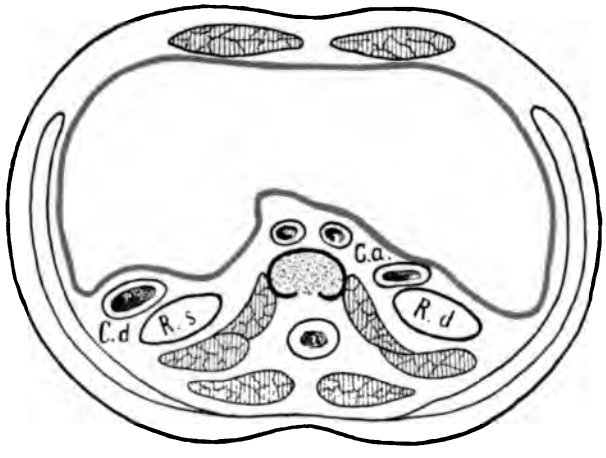


FIG. 342.—HORIZONTAL SECTION THROUGH THE ABDOMINAL CAVITY IN THE REGION OF THE KIDNEYS. (Diagrammatic.) (Original.)

it reaches the anterior abdominal wall above, under the arch of the ribs, while the inferior pole grows down toward the pelvis. If the enlargement continues, the growth oversteps the median line, causes distention of the other side of the abdomen also, and descends into the true pelvis; hence an extramedian position and immobility of the tumor, owing to its extraperitoneal growth (providing the kidney is not movable), are the most characteristic features of renal tumor and are easily recognized. The palpation of small tumors may be difficult and may require a favorable attitude with relaxed abdominal walls, and possibly anesthesia. The woman should be examined in the dorsal or in the lateral position, both hands being used. One hand is placed under the renal region and the other on the tumor. Mobility may be entirely abolished, or present only in a slight degree in the parts directed toward the abdominal cavity. Firm and tense tumors situated in the renal region as far as the vertebral column are easily palpated; if not, they may be

demonstrated by the constant absence of the intestinal note on percussion at the affected site. In the case of large tumors, also, it can usually be determined without difficulty that one side of the abdomen is free and that the tumor extends on the other side into the lumbar region (Fig. 343). If, however, the tumor forms in a movable kidney, or has produced a movable kidney by dragging on the peritoneal investment, the tumor may be depressed into the umbilical region and even deeper; but it can be pushed back into the lumbar region unless it has become adherent in its new position. The percussion note over a tumor containing a movable kidney may show intestinal tympany because the peritoneum

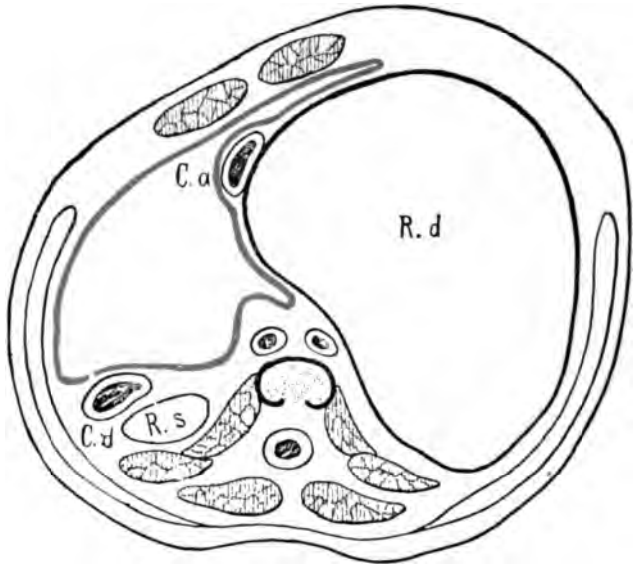


FIG. 343.—HORIZONTAL SECTION THROUGH A RENAL TUMOR IN SITU. (Diagrammatic.) (Original.)

has been drawn out to form a wide band, and the tumor is farther removed from the posterior abdominal wall.

The relations of the renal tumor to the large intestine are even more important. As the renal tumor grows, whether on the right or left side, it forces the colon away from the lateral wall of the abdomen, so that the bowel is usually found along the inner side of the tumor. Large tumors may be behind the lower portion of the ascending colon, and the latter in this case will occupy a vertical position in front, and to the inner side of the tumor; while the hepatic flexure of the colon forms an oblique, ascending line, merging with the transverse colon (Fig. 344) and draped, as it were, over the top of the tumor. When the tumor is on the left side, the descending colon above usually lies vertically in front of the tumor; while the sigmoid flexure, on account of its well developed mesentery, is not much altered in position. This

change in the position of the colon may almost be called a law, although it is subject to a number of exceptions, as when the tumor grows forward along the inner side of the intestine and displaces the latter outward. If a right-sided tumor grows downward under the cecum toward the pelvis, the cecum is displaced upward and is in contact only with the upper portion of the tumor; if there are inflammatory adhesions attaching coils of intestine to the surface of the tumor, or to one another, the bowel is not displaced at all or the displacements are irregular. The presence of the large intestine on the tumor is usually easy to determine; while it is empty it represents a flat ribbon which can be slightly moved to and fro on the tumor; and gurgling or purring noises are sometimes present. Inflation with air renders the recognition somewhat easier; the inflation should be done with an atomizer through the rectum. As gases and fluid do not pass backward through Bauhin's valve, the accumulation of gas and fluid may be regarded as a specific sign that the structure is the large bowel.

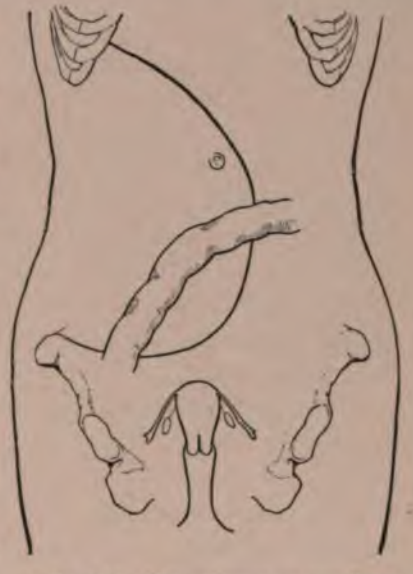


FIG. 344.—RENAL TUMOR OF THE RIGHT SIDE. P.-F. ⅙. The ascending and transverse colon pass obliquely over the tumor and are empty. The tumor is extraperitoneal and immovable.

Before the introduction of cystoscopy, important diagnostic points were obtained from examination of the urine, since in the presence of a healthy bladder pus was regarded as pointing to pyonephrosis, and hematuria to a neoplasm of the kidney. At the present day, however, cystoscopy in connection with catheterization of the ureters has completely replaced the older methods. Although it is true that the diagnosis of renal tumor can be made in most cases without cystoscopy, nevertheless the method sometimes affords an important confirmation, and in doubtful cases provides the only basis for the diagnosis. In a retention tumor with a completely closed ureter, the canal will appear absolutely 'dead' when examined with chromocystoscopy; and when cystoscopy cannot be performed, the closure of the ureter is directly felt when a catheter is introduced. The closure of the ureter and absence of urinary flow are recognized by catheterization of the ureters. If the ureter is still permeable, bloody or purulent urine, or pure pus, or even particles of tissue will escape in the case of renal tumors. In the case of open sacs, particularly pyonephrosis, the diagnosis is readily made by seeing the pus escape from the corresponding ureter.

Cystoscopy in Renal Tumors.

CASE 38. Mrs. R. On the right side a renal tumor about the size of a man's head, exhibiting all the characteristic palpatory signs. On cystoscopic examination the bladder is found to be perfectly normal; the left ureteral orifice is very small, and clear urine is discharged; the right is greatly reddened and injected, and projecting from it is a thick drop of pus. Pressure on the tumor is followed after a few seconds by the discharge of thick pus in the shape of a small sausage, which sinks in the injection water and slowly dissolves. After extirpation the tumor was found to be a right-sided pyonephrosis with calculus.

Differential Diagnosis. The gynecologist is interested solely in the distinction of renal tumors from ovarian tumors. Confusion of the two conditions is possible only when the renal tumor is large enough to extend into the pelvic inlet, or the ovarian tumor reaches up to the region of the kidney, which may occasionally occur in the case of small tumors that have ascended with the gravid uterus, or have been prevented from descending during the puerperium by the formation of adhesions in the lumbar region. Small ovarian tumors with long pedicles may also be displaced into the lumbar region. The chief point of distinction is that renal tumors have no direct connection with the uterus, and that both ovaries can sometimes be felt underneath the tumors; whereas ovarian tumors are more or less distinctly connected to the uterus by a cord. But as this cannot be positively demonstrated in a number of cases, the above-mentioned characteristic signs of renal tumor also assist in the diagnosis. An ovarian tumor rarely occupies only half of the abdomen, leaving the other half entirely free. In most cases intestinal tympany is obtained at the outer side of the tumor, but in the case of renal tumors the percussion note is usually dull in that region. While renal tumors by traction on their peritoneal covering may develop a certain degree of mobility, they are always more or less adherent above and impeded in their downward movement; whereas in ovarian tumors the opposite conditions obtain. Ovarian tumors never exhibit the same relations to the colon as renal tumors; at all events, they are never placed behind the upper portion of the ascending or descending colon. The transverse colon, however, may lie along the top of a large ovarian tumor, and large subperitoneal growths may be placed behind the cecum on the right side and behind the sigmoid flexure on the left. The cecum and sigmoid flexure are easily recognized by their shape, especially the latter by its long mesentery. In difficult cases resort must be had to cystoscopy and catheterization of the ureters. Valuable information may also be obtained from the history and symptomatology. If the appearance of a tumor has been preceded by renal symptoms, *i.e.*, renal colic and persistent pain in the lumbar region, or if the patient knows that the tumor started in the lumbar region and grew downward, the tumor is probably renal. Slow growth and the appearance of the tumor during childhood are much more frequent in the case of renal tumors.

Differential Diagnosis from Ovarian Tumors.

The following case illustrates the difficulties of a differential diagnosis between ovarian and renal tumors:

The history contains nothing characteristic.

The growth of the tumor is said to have begun below; the abdomen is greatly distended by a cystic tumor twice as large as a man's head, and entirely in the median line. In the left lumbar region there is distinct tympany; in the right, the note has a tympanitic element. On the right side the right lobe of the liver is distinctly palpable in intimate contact with the tumor, and projects four fingers' breadth beyond the arch of the ribs. A loop of intestine is felt on the left side of the tumor, somewhat movable on the surface; this can be inflated, but the air does not advance beyond a certain point (Bauhin's valve).

The uterus is small and lies underneath the tumor; the right ovary is palpable; the left cannot be found.

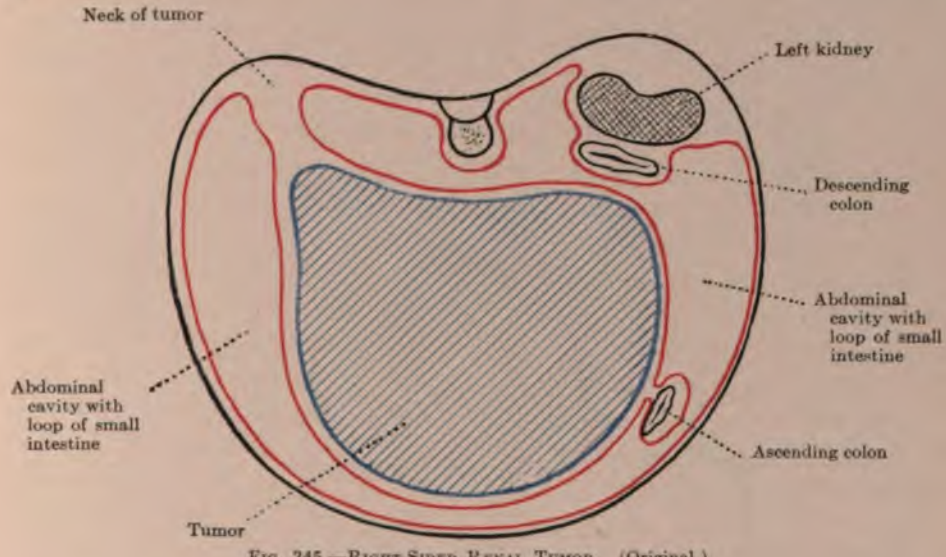


FIG. 345.—RIGHT-SIDED RENAL TUMOR. (Original.)

Nothing of any importance is found in the urine. Cystoscopy was not performed for practical reasons (judging from the final diagnosis it would probably have shown normal urinary secretions from both ureters).

The diagnosis lies between left-sided ovarian tumor and right-sided renal tumor.

In favor of ovarian tumor are the median position, the percussion note in the two lumbar regions, the absence of the left ovary, and the history.

In favor of renal tumor are the position of the colon on the tumor, and, as the manner in which the air entered during inflation showed it to be the cecum, it could only be a right-sided renal tumor.

Operation revealed a right-sided renal tumor. A neoplasm had probably developed in a movable kidney, which explained the median position and the distinct tympany on the side on which the tumor originated. The left ovary was not absent, but was found above, pressed against the abdominal wall. The anatomic relations are shown in the accompanying transverse section (Fig. 345).

Microscopic examination revealed a sarcoma of the right suprarenal body.

Diagnosis of Movable Kidney. Movable kidney is an exceedingly common complaint among women. The condition is suggested by the patient's complaining of distress in the lumbar region, or by the acci-

dental finding of a tumor on palpating the abdomen. In diseases which are often associated with movable kidney, such as enteroptosis, pendulous abdomen and prolapse, the patient should always be examined for displacement of the kidneys.

In examining for movable kidney the patient must be placed in such a position as to relax the abdominal muscles and permit the kidney to leave its normal position. In other words, the woman should be placed on the sound side, with the knees slightly drawn up. In this position the kidney often slips down to, or beyond the navel. Examination after the patient has suddenly changed from the dorsal to the lateral position, or after active exercise is of advantage. If the abdominal walls are thin, the outline of the kidney can sometimes be seen; but as a rule the diagnosis must be made by palpation. One hand is placed under the lumbar region, the other flat on the abdomen in the hypochondriac region and, if the abdominal walls are not too thick, a tumor of the size, shape, and peculiar parenchymatous consistency of the kidney may be felt on deep inspiration. Occasionally the hilus, which is directed inward, is distinctly palpable (Fig. 346), and under favorable circumstances the pulsating renal artery within the hilus; sometimes only the inferior pole of the organ can be felt. In such cases examination in the dorsal position after deep expiration is the best. If the displacement of the kidney is not very great, the organ is felt more easily in the sitting or standing posture with the trunk bent over forward.

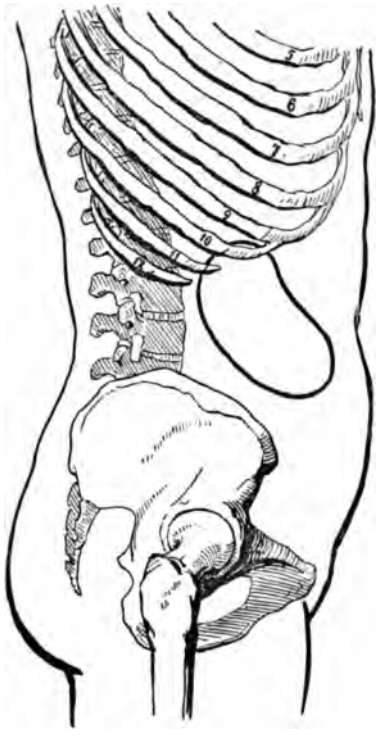


FIG. 346.—RIGHT-SIDED MOVABLE KIDNEY IN THE LEFT LATERAL POSITION. (Original.)

Movable kidney is further characterized by great mobility, so that it often slips away from between the fingers, and by the fact that it can be returned to its normal site.

Absence of the kidney on the affected side, even if it can be positively demonstrated by palpation and percussion, is not a positive sign of movable kidney, as it is also observed in atrophy and ectopia of the kidney.

Differential Diagnosis. A number of conditions which produce similar tumors in the lumbar region must be considered; but if the above-mentioned signs of movable kidney are borne in mind, there is practically

but one condition on the right side that may be mistaken for movable kidney. This is constriction of part of the liver substance (Schnürleber), which may be similar in shape and consistency to that of a movable kidney. It is sometimes difficult to demonstrate the connection between such a constricted portion and the liver, and quite frequently the mass is not movable with respiration; but it may be recognized by its sharp border, like that of the lower edge of the liver, and the fact that it cannot be replaced into the kidney site.

The spleen is not very likely to be mistaken for a movable kidney, because the viscus does not appear below the arch of the ribs unless it is movable, which is a very rare condition. The spleen also differs from the kidney by its shape and notches. Sometimes the distinction can be made by attempting to replace the movable mass; if it is the spleen, it will return to the normal site of that organ underneath the arch of the ribs, while the kidney disappears in the depth of the abdomen toward the vertebral column.

Partial contractions of the abdominal muscles may simulate movable kidney, but they disappear after a time and under anesthesia. Fibromata in the abdominal muscles may produce similar physical signs, but they are more superficial and have but little mobility.

While the mere diagnosis of movable kidney by palpation is in the main easy, it may be difficult to decide in a given case what clinical significance the condition may possess. It must be remembered that in itself a movable kidney merely represents an anatomic abnormality, and in the vast majority of cases produces no symptoms whatever. It can be called a pathologic condition and requires treatment for such only when the symptoms present can be positively referred to the movable kidney, and this is by no means easy. The most characteristic symptoms of pronounced displacement of the kidneys are the sudden attacks of pain, which are due to kinking of the pedicle, and which find their explanation in an acute hydronephrosis following kinking of the ureter, and sudden hyperemia with swelling of the kidney and tension of its capsule, following kinking of the veins. The attacks of pain are very intense, localized in the lumbar region, and accompanied by vomiting, colic, prolapse, weakening of the pulse, and syncope. At the height of the attack the kidney feels swollen and is very sensitive. Sometimes the symptoms disappear suddenly, as the obstacle subsides. There is another group of indefinite symptoms, such as drawing pains in the corresponding side, nausea, vomiting, pain in the stomach, pressure in the abdomen, and a variety of nervous phenomena; but these can be attributed to a movable kidney only if there is no other way of explaining them. Quite often the organ has to be replaced and fixed in its normal position before their etiologic connection with the movable

kidney can be definitely proved. Sometimes the patients are more definite in their statements; they feel a movable body in the lumbar region which moves with every change of position; or they note the sudden appearance and disappearance of a tumor with certain movements of the body. Whenever the symptoms are indefinite, all other possible causes must be positively excluded, especially inflammatory diseases of the adnexa and, in the case of right-sided movable kidney, appendicitis.

Dystopia of the kidneys, or congenital position of the kidney in an abnormal place, interests the gynecologist because the organ is frequently found is the genital regions and may be mistaken for a tumor. The diagnosis of this condition is extremely difficult and has not been made more than once or twice in the living subject; nevertheless, dystopia is characterized by certain definite signs which might make the diagnosis possible, provided the condition was thought of. It should be remembered that the kidney must be retroperitoneal and therefore possesses but little mobility, and is in fact, as a rule firmly fixed to the body wall; it is usually to one side of the promontory in front of the sacro-iliac articulation, or on the anterior surface of the sacrum. An attempt should be made to outline the shape of the kidney by palpation. This can be done only if the organ can be reached through the vagina or rectum, or through the thin abdominal walls if it is situated on, or to one side of the vertebral column. If it is possible to make out by palpation the shape and consistency of a kidney, and especially the hilus, the diagnosis is not difficult; but as a displaced kidney is often atrophic, misshapen and lobulated (as during fetal life), and as hydronephrosis may form in a dystopic kidney, the difficulties are sometimes very great. If an artery can be felt in the hilus, as in some reported cases, it is a lucky accident. If at the same time the absence of the kidney from its normal position on the corresponding side can be demonstrated by palpation, it is another valuable diagnostic point.

Catheterization of the ureters may yield important information. According to Müllerheim, shortening of the corresponding ureter is a sign of dystopia. Since the flow of urine from the ureter is intermittent, while the flow is continuous from the pelvis of the kidney, Müllerheim measures the ureter by determining the difference in length on the catheter between the instant when the point enters the ureter and the instant when the continuous flow of urine from the pelvis of the kidney begins. Radiography is, however, a more certain method of recognizing dystopia of the kidneys. A lead catheter is introduced into the ureter of the corresponding side, and its course in the tumor definitely determined. If the dystopia is associated with complete atrophy of the kidney, which is not infrequently the case, the absence of renal function on the cor-

responding side, as determined by chromocystoscopy or catheterization of the ureters, or the absence of a ureteral orifice (T. Cohn), may assist in making the diagnosis.

The following case came under my personal observation:

CASE 39. Mrs. Z. To the left of the sacral portion of the vertebral column a circumscribed mass about as long as a finger and two finger's breadths wide, with a smooth surface, is felt, the inferior pole of which extends down to the promontory. The lateral border appears convex, while the median has a notched edge like a hilus. Along the upper edge a distinctly pulsating cord is felt running across the upper surface in a flat curve. The right kidney is palpable in its normal position, but the left cannot be found even after repeated careful palpation. The uterus and adnexa on both sides are normal. Diagnosis: Dystopia of the left kidney. Chromocystoscopy shows a normal swelling around the ureteral orifice and the regular escape of urine from the canal; on the left side it is impossible to see either a normal orifice or a stream of urine during a period of observation of twenty minutes. A second examination gives the same result, hence the dystopic kidney is atrophic (T. Cohn).

Differential Diagnosis. A kidney situated in the pelvis may be mistaken for a tumor of the genital organs. Depending on the spatial relations of the kidney to the ureters or adnexa, it may be mistaken for a myoma, a tubal tumor, or, if a hydronephrosis has developed, an ovarian cyst. If the possibility of this renal abnormality were borne in mind, the diagnosis would no doubt be made more frequently from the above-mentioned signs.

Ten years ago I saw a case in which I made a diagnosis of adnexal tumor based on the symptoms and the similarity of the physical signs. At the operation I satisfied myself by palpation that a dystopic kidney was present.

Analytical Diagnosis.

My original thought in writing the special diagnosis was to indicate the lines to be followed in making the diagnosis of a gynecologic disease. The methods of gynecologic examination are such that the information obtained by combined examination is very much more important than the symptomatology, which may, however, be of some assistance when the results of combined examination are not sufficiently definite. In a text-book a systematic treatment of the subject is absolutely essential, but it must be borne in mind that it does not represent the method which the physician must pursue in actual practice in order to arrive at a diagnosis. Thus, for example, he will hardly go through the various stages of an examination for a myoma unless he already suspects the existence of such a tumor, or examine his patient for catarrh of the genitalia unless the diagnosis is suggested by the presence of certain symptoms. He who approaches a case without any preconceived ideas in regard to the direction which the diagnosis is likely to follow must at first reckon with the sum total of all known diseases. He will obtain the first hint from the patient's statements and must analyze the symptoms complained of in order to get a clear idea in regard to the seat of the particular disease in question. I have tried to meet this analytical need of the general practitioner by adopting, as far as possible, an analytical method in the part devoted to special diagnosis, as in the diagnosis of diseases of the bladder, catarrh, new formations and ulcerations of the vulva; but in the case of most gynecologic affections this method is not applicable, and the first hint will be suggested by a single symptom or by first impressions. Thus, for example, displacement may suggest a myoma and the diagnosis must then be confirmed or disproved by invoking the aid of all known diagnostic methods. If gynecologic processes were characterized by pathognomonic symptoms, these would indicate a definite line for the diagnostician to follow. Since however the opposite is the case and gynecologic symptoms consist in the main of hemorrhage, abdominal pain and vaginal discharge, and since they repeat themselves in a variety of forms in different gynecologic affections, the symptomatology has no practical diagnostic value. While an accurate observer who has an intimate knowledge of gynecologic symptoms may be able to arrive at a diagnosis by analyzing the most prominent symptom in the case and, with the aid of various secondary factors, resolving it

into special subvarieties, such a method of procedure is beyond the ability of the less experienced general practitioner, although he also should try to attain his object in the same way. Such a knowledge of analytical diagnosis I consider particularly necessary to a physician in the interpretation of hemorrhage, the most frequent and the most important gynecologic symptom. In addition there are certain other gynecologic complaints which are so definite that they almost have the significance of a separate disease, particularly among the laity, although in reality they merely represent symptoms; they are amenorrhea, dysmenorrhea, and sterility. In the patient's mind severe pain during menstruation, the protracted absence of the menses, and sterility represent definite conditions which may be present without any other symptoms and often constitute the only reason for which medical advice is sought. The physician, however, must free himself from any such idea. To him these conditions are merely symptoms of a gynecologic or general disease, and their importance is enhanced by the fact that they occur in a great many quite different diseases. Hence he must proceed analytically and, after duly considering the special symptoms as well as the general findings, strive to recognize the causal condition. For this reason I have added a section on the analytical diagnosis of hemorrhage, amenorrhea, dysmenorrhea and sterility, as well as a short discussion of abdominal tumors. (The subject of vaginal discharge has been discussed in the chapter on the diagnosis of catarrh.)

The Causes of Hemorrhage.

A physician is often called upon to determine the causes of hemorrhage from the genitalia because successful treatment usually presupposes correct recognition not only of the source, *i.e.*, the bleeding organ, but also the cause of the circulatory disturbance. Quite often the question is solved coincidentally with the discovery of a genital disease known to have a tendency to hemorrhage, such as a uterine myoma; but not infrequently the genital disease itself cannot be regarded as the direct cause of the hemorrhage, as in the case of an ovarian tumor or a retroflexed uterus; or the palpatory findings may be normal, and the cause of the hemorrhage may be discovered only by a general examination of the entire body or a study of the history. Hemorrhage is frequently the expression of functional disturbance and not a symptom of organic disease.

To discover the cause of a hemorrhage the physician should proceed as follows:

Certain historical data, such as the type of hemorrhage, *i.e.*, whether menstrual (menorrhagia) or intermenstrual (metrorrhagia), must be determined. Women call any hemorrhage from the genitalia "period," whereas in a medical sense the term is restricted to the hemorrhage from the mucous membrane which occurs in the course of ovarian activity and coincident with the menstrual (monthly) congestion. It is often difficult to unravel the patient's statements. Some women calculate the duration of the menstrual interval from the beginning of the previous period and others from the end. For example, a woman may say that her period comes every two weeks, when in reality she has an interval of two weeks and her period, which lasts a week, recurs every three weeks. The physician must therefore determine by judicious questioning the time when the menstrual flow occurs and the length of the interval, in order to get an idea of the type of hemorrhage he is dealing with. If the periods are variable in severity and duration, or the length of the interval is not constant, it may be very difficult to distinguish between menorrhagia and metrorrhagia, and in such a case it is best to note the date of the appearance of each hemorrhage and its duration. The problem is greatly simplified by keeping hemorrhage-charts, the didactic value of which was pointed out by Kaltenbach. I have introduced these charts (see Plate) with certain modifications in my gynecologic service. They can be kept by the patients themselves and shown to the physician from time to time. One

glance at such a chart is often more instructive than a long and usually more or less confused statement from the patient.

The type of the hemorrhage serves to indicate whether

(a) The hemorrhage is menstrual (menorrhagia). The cause of menorrhagia may be anything that tends to prolong or increase the menstrual congestion, such as a recent adnexal disease; or which delays the completion of the menstrual flow, such as endometritis, relaxation of the uterus; or which leads to abnormal vascularity of the uterus, such as a myoma; or which modifies the regulating apparatus of the nervous system, such as general debility (Charts I, IV).

(b) The hemorrhage is intermenstrual (metrorrhagia). The conditions in this form have nothing whatever to do with menstrual congestion; the hemorrhages are due to vascularity, as in carcinoma of the uterus, polyps, circulatory disturbances due to fright, acute inflammation (Chart V).

(c) The hemorrhage is preceded by a variable period of amenorrhea. The cause in this case is usually found in disturbances of the pregnant state (Charts II, III).

In many cases the type of the hemorrhage is indicated by local or general molimina, which give the pathologic hemorrhage the character of a menstrual flow accompanied by the usual symptoms.

The patient's statements with regard to the **exciting cause** of the hemorrhage, particularly if it is extramenstrual, may also be of value. The time of menstrual hemorrhage is determined by the menstrual congestion, but the time of occurrence and the course of the latter may be affected by local and general conditions of various kinds, such as hard physical work, nervous excitement or weakness, which have no diagnostic value. Extramenstrual hemorrhages require special causes for their occurrence and these causes are often external and easily recognized.

They include traumatism, which may either affect the bleeding spot directly or produce rupture indirectly by increased pressure on the vessels. Coitus, vaginal irrigation and internal examination make up the direct traumatisms, but these occasional causes never produce hemorrhage from a normal mucous membrane. They presuppose an exposed tumor or a laceration, or a hyperemic mucous membrane covered with delicate cylindrical, instead of robust squamous epithelium. Hemorrhage following coitus has a certain value as a pathognomonic sign of its most frequent cause, cancer of the cervix; although erosions, ulcerations and mucous polyps may bleed from the same cause. Coitus may also cause hemorrhage indirectly through the associated engorgement of the vessels. If the latter are friable, or their structure is altered as in endometritis and neoplasms in the uterine cavity, coitus may be followed by hemorrhage. Hence this type of hemorrhage points to a

does not bleed unless it is injured, usually during coitus, and bleeding lacerations can be either felt or seen. Among the changes recognizable by palpation which may be the source of the hemorrhage may be mentioned carcinoma, sarcoma, gummata and decubital ulcers caused by the pressure of a pessary. Hemorrhages without palpable changes in the mucous membrane are seen in macular colpitis, especially in old women, because the squamous epithelium is attenuated and the vessels in the hyperemic papillæ may be ruptured by the slightest touch or by a local increase in blood pressure. Mere contact with a cotton pledget may cause the blood to exude from the individual macules.

Vagina.

It is not difficult to determine whether the **vaginal portion** is the source of the hemorrhage. Distinct palpatory changes may be present or, if the mucous membrane is intact, the hemorrhage may be directly seen in the speculum. Unless one of these conditions is present, the blood is probably not derived from the vaginal portion. Any condition in which the mucous membrane is destroyed by ulceration and in which erosion of the vessels takes place may be responsible for the hemorrhage—carcinoma, sarcoma, all kinds of ulcerative processes, such as tuberculous, syphilitic, cauterization- and decubital ulcers, rarely mucous polyps. Hemorrhage from an intact vaginal portion with well preserved squamous epithelium is exceedingly rare. On the other hand, there are a number of alterations in the mucous membrane which may be the source of hemorrhage, such as erosions, circumscribed vascular engorgement of the papillæ similar to conditions seen in senile or maculous colpitis; so-called Fischel's erosions, or true ulcerations exposing the infiltrated stratum mucosum after separation of the squamous epithelium. Lesions of this kind are very apt to bleed, particularly after mechanical irritation such as that incident to coitus and a gynecologic examination, and in the presence of inflammatory disturbances resulting, for example, from physical overexertion or psychic excitement. But as these alterations of the mucous membrane do not always produce hemorrhage, and as they may be associated with disease affecting portions situated higher up which may also cause bleeding, it is important to decide whether the blood is really derived from the vaginal portion or whether the uterus is also the seat of hemorrhage. Mistakes in this direction may be avoided by noting the type of the hemorrhage with reference to the causes found in the vaginal portion and by a systematic examination of the uterine body, which is a most frequent source of genital hemorrhage. In this connection I may cite the following cases:

Vaginal Portion.

CASE 40. Mrs. K. The patient has been suffering for some time from irregular, severe hemorrhages occurring without definite cause. Examination reveals a mucous polyp of the vaginal portion almost as large as a walnut; but the hemorrhage is not of the kind that

corresponds to this tumor, as the patient complains only of severe menorrhagia, often lasting from two to three weeks. The endometrium is very rough and the diagnosis of fungous endometritis is therefore made and confirmed by microscopic examination of the scrapings.

Case 41. Miss P., 68 years of age. Menopause 20 years ago; for the past 8 weeks slight bleeding at intervals and once a severe hemorrhage following an irrigation. The external os contains a mucous polyp as large as a plum-stone, which is regarded as the cause of the hemorrhage. After this polyp had been twisted off, the bleeding stopped for 5 months; then it recurred and has been present with variable intensity for almost 7 months. At the present time no mucous polyp is found, but instead a distinctly thickened and retroflexed uterus. Curettage yielded large quantities of mucous tissue, apparently derived from a mucous polyp, which was probably responsible for the original bleeding also.

If the vaginal portion can be definitely excluded, the blood must be derived from the uterus. In that case the character of the hemorrhage is much more difficult to determine, because the bleeding spot cannot be directly seen or felt unless the changes are limited to the lower portion of the cervical substance, or the external os is widely dilated. The conditions to be examined for under these circumstances are carcinoma, sarcoma, myoma and mucous polyp of the **cervix.** The intact cervical mucous membrane does not bleed; and a diseased cervical mucous membrane much more rarely than that of the body because it is not subjected to physiologic changes in vascularity. On the other hand, slight hemorrhage is observed in acute infectious catarrh with marked hyperemia of the mucous membrane and in chronic hyperplastic conditions with the development of small vascular polyps.

Cervix.

If the cervix is also found to be quite healthy beyond the possibility of a doubt the hemorrhage must come from the **uterine body,** as it is a more frequent source than any other portion of the genital apparatus. The diagnosis of uterine hemorrhages covers a large field, including diseases of the uterus and adnexa, general organic and nervous diseases, and temporary disturbances of the circulation. To pick out the true cause from all these conditions is in my opinion one of the most difficult tasks that the physician is called upon to perform. Any bleeding other than that of menstruation is abnormal; excessive menstruation and irregular bleeding of every kind are pathologic and must have a special cause. It is advisable in searching for these causes to follow a definite line of examination in order, if possible, to discover some objectively demonstrable disease.

Body of the Uterus.

We first look for some **disease of the uterus** by determining, with the aid of palpation, the size, consistency and position of the organ, in the hope of finding some clue to the cause of the hemorrhage.

If the uterus is distinctly enlarged, it may be a sign of disease of the wall or endometrium, viz., myoma, sarcoma, carcinoma, syphilitic or chronic metritis in combination with chronic endometritis. The absence of enlargement, however, does not exclude the possibility of a

small submucous myoma or beginning carcinoma. (For the diagnosis of these conditions see the corresponding chapters.)

If the uterus, besides being enlarged, is also softened, some disturbance of pregnancy suggests itself, such as hemorrhage from a gravid uterus in decidual endometritis, placenta prævia or traumatic hemorrhage; hemorrhage in any state of abortion, retention of a dead ovum, or subinvolution after abortion or parturition.

The only displacement of the uterus that needs to be considered as a possible cause of hemorrhage is retroflexion. When it is recent, and particularly during the puerperium, this condition produces acute metrorrhagia; while in chronic retroflexion menorrhagia occurs as the result of disturbances and relaxation of the uterus and its vascular apparatus.

If no changes of this kind are found in the uterus by palpation, the cavity is to be explored with the sound. If the entire mucous membrane is found to be smooth it is probably healthy. Distinct roughness usually, but not always, indicates either benign (fungous endometritis, decidual remains) or malignant diseases (carcinoma, sarcoma of the mucous membrane). If the cavity appears to be irregularly contracted, submucous myomata may be present; but in that case the sounding should be confirmed by digital exploration and curettage (see the respective chapters).

If the uterus presents nothing abnormal and cannot be regarded as the direct cause of the increased bleeding, the physician must turn his attention to the surrounding structures and look for the cause of these so-called **secondary uterine hemorrhages** in diseases of the adnexa, the peritoneum or the parametrium.

Among tubal diseases we must consider recent or very large pyosalpinx, which often occasions protracted and profuse menstruation coming on ahead of time and sometimes quite irregular menses; acute exacerbations of tubal diseases are usually attended by renewed hemorrhage. Chronic tubal disease and chronic adnexal tumors are much less likely to be the direct cause of purely secondary uterine hemorrhages; in most cases the hemorrhages are due to the coexisting endometritis. A tubal pregnancy if found is in some way associated with the uterine hemorrhages. If the fetus is alive, hemorrhage is absent or very slight; but after death of the fetus, in the presence of tubal mole and peritubal and retro-uterine hematocele, protracted hemorrhages usually occur. The bleeding is never derived from the tubal disease, as such a thing is inconceivable unless the orifice of the tube is dilated and the blood remains fluid; it is always due to congestion and subinvolution.

Secondary Uterine Hemorrhages

In spite of the close relation existing between ovarian function and uterine bleeding under normal conditions, changes in the ovaries

rarely produce hemorrhage from the uterus. In rare cases an ovarian tumor that has developed on one side may cause metrorrhagia. A little more frequently the symptom is observed in the presence of bilateral tumors during the menopause and particularly when both ovaries are the seat of carcinoma. In most cases these hemorrhages are undoubtedly to be regarded as secondary; but as metastasis in the body of the uterus is possible, the endometrium should be examined with special care. Inflammatory ovarian disease occasionally causes uterine hemorrhage. In acute conditions irregular hemorrhages sometimes occur, while in chronic oöphoritis irregular, protracted and excessive menstruation is not uncommon; whether these symptoms are also secondary or whether they are due to the accompanying endometritis is often difficult to decide.

Another cause of uterine hemorrhage is found in pelvic peritonitis. In the acute stage and in acute exacerbations of chronic conditions irregular uterine hemorrhages of moderate duration may occur; these hemorrhages are purely symptomatic and frequently represent the initial symptoms of the disease. If metrorrhagia is present in chronic peritonitis with adhesions and exudation, an associated chronic endometritis is extremely probable, except in the case of large exudates, which may also produce congestive hemorrhages. Large collections of blood in the peritoneal space are almost always attended by uterine hemorrhage without any definite characteristics and extending over several months.

Diseases of the parametrium, whether acute or chronic, are very rare causes of uterine hemorrhage. Whenever the inflammation is chronic there must always be a suspicion of complicating endometritis as in the case of chronic peritonitis, especially if the bleeding presents the type of the menstrual flow.

If the adnexa also fail to show signs of being the cause of the hemorrhages, the physician is confronted with the very difficult and often impossible task of explaining **a hemorrhage without any abnormal physical signs.** It is needless to say that under these circumstances mistakes are necessarily very frequent, hence one should attempt to find the cause in some definite pathologic condition and not give too loose a rein to mere hypothesis. I shall accordingly confine myself to the discussion of those causes which are easily intelligible and universally acknowledged, and avoid mere possibilities.

The causes of a hemorrhage without abnormal physical signs may be general or **local** and, since the latter are much more frequent, they should form the first object of investigation. There may be only a single, severe hemorrhage, or menorrhagia may occur with each menstruation. In the former case the hemorrhage may possibly represent merely an excessive menstruation, which is not recognized as

such because it is the first to occur after the puerperium, an abortion or parturition, or after a long period of amenorrhea. The accompanying molimina or certain psychic or bodily sensations may help to identify the hemorrhage as a menstruation, but in most cases a positive diagnosis can be made only by the subsequent course. For practical reasons it is important to distinguish a first menstruation of this kind following parturition or abortion from a hemorrhage due to retention of fetal parts. If the hemorrhage is a menstrual flow, sounding is negative and an interval of freedom from hemorrhage must have occurred after the abortion. Single excessive hemorrhages, whether menstrual or intermenstrual, may occur after some violent emotion, fright, sudden changes of temperature, especially cold baths and injuries. They may also be brought on by indiscretions during the menstrual period such as dancing, gymnastics, bicycling, sexual excitement or hard physical labor. It is not always easy to ferret out the direct cause of these acute circulatory disturbances, but it is important to decide whether the hemorrhage is merely an excessive menstruation or the initial symptom of an inflammatory disease. Climacteric hemorrhages are characteristic and may occur once or repeatedly; they are probably explained by atrophy of the mucous membrane and insufficiency of the muscularis. They are recognized as climacteric by the long intervals, which often extend over several months, the associated symptoms of cardiac weakness (swelling, vertigo, headache), and characteristic age of the patient. In old women acute hemorrhages of this kind are occasionally due to degeneration of the vessel walls.

If the patient states that a severe hemorrhage recurs regularly with each period, in other words, that there is menorrhagia, one of the following causes may be present.

Relaxation of the uterus, or abnormal dilatation of the cavity with a relaxed and attenuated muscularis. The menorrhagia is due to the absence of counter-pressure in the cavity and the fact that the muscularis is unable to regulate the inflow and escape of the blood. Relaxation is observed after abortion and parturition in cases of subinvolution; for this reason the first menstruation is usually very severe. Multiparous women who have had numerous confinements in rapid succession menstruate much more profusely than nulliparæ. The distinction from endometritis is not easy; occasionally inequalities on the surface of the endometrium may be discovered with the sound, but as a rule the diagnosis has to be decided by the microscope. Dilatation of the cavity and tenuity of the uterine wall can sometimes be recognized with the sound.

Hyperemic conditions of the uterus lead to menorrhagia as the result of active engorgement of the blood-vessels or passive con-

gestion. The former results from too frequent sexual excitement (before marriage); coitus without completion of the sexual act (impotence on the part of the man, interrupted coitus, the use of a condom, onanism); the reading of salacious literature; indulgence in lewd thoughts; excessive use of the sewing machine; and mental overexertion. Passive hyperemia results from varicose dilatation of the efferent pelvic veins, tight lacing, and constipation. As the hyperemia is not limited to the uterus, the reddening of the vagina and vaginal portion and other signs of congestion in the pelvic veins (hemorrhoids) furnish useful hints as to the cause of the hemorrhage. In acute catarrh of the vagina and of the cervix, and in acute parametritis and perimetritis menorrhagia of a purely symptomatic nature may occur even when the endometrium is not diseased.

If the hemorrhage cannot be explained by local causes, recourse must be had to general conditions, especially **internal diseases** which, however, are extremely rare causes of hemorrhage. Menorrhagia may be brought into etiologic relation with the following groups of diseases:

(a) Acute infectious diseases, in which the endometrium is very probably directly involved in the infection; these include influenza, typhoid fever, cholera, scarlet fever, variola, articular rheumatism and malaria.

(b) Diseases attended by a general tendency to hemorrhage, as morbus maculosus, hemophilia, scorbutus.

(c) Diseases which produce congestion in the veins of the abdomen, as uncompensated cardiac lesions, diseases of the liver, pulmonary emphysema.

(d) Chronic debilitated states due to various causes, with weakening of the vasomotor apparatus and consequent prolongation of the hyperemia, resulting in hemorrhage. In delicate women any disturbance of the general health may bring on changes in the type and severity of the menstrual flow.

Objective demonstration of the hemorrhage and personal observation of the quantity of blood discharged have the advantage of making the physician independent of his patient's statements, whose notions in regard to what is a permissible flow of blood are often very peculiar. In addition certain valuable information which may occasionally assist the diagnosis is obtained from the **appearance of the blood**—the quantity and color, the presence of clots and the admixture of other secretions and tissue elements. While, as compared with finding the cause of the hemorrhage, this method of examination has of course only a comparatively small value, it may nevertheless assist in making the diagnosis in certain characteristic cases. The normal menstrual flow is watery unless it contains a considerable

admixture of mucus. The color is dark red (carmine) or black, the odor quite characteristic and sometimes slightly fetid. Clotting is prevented by the genital secretions. The presence of recent blood that coagulates promptly points to a recently opened source, as in abortion, polyps, degenerating malignant tumors, particularly after digital exploration or sounding of the uterine cavity, in endometritis and in retention of decidual tissue. Coagula, commonly described as 'pieces,' usually indicate that the hemorrhage has been so profuse that the alkaline secretions of the uterus have been insufficient to prevent coagulation. Coagula are always pathologic and occur when the menstrual flow is excessive, with abortion, polyps and degenerated tumors; protracted hemorrhage of moderate severity, as in hematocele, is rarely accompanied by the formation of coagula. A dirty brown appearance of the blood indicates that it has been retained in the uterus for some time and subjected to chemical changes. The discoloration is most frequently observed in the hemorrhages of pregnancy, in which the last of the blood finally appears merely as a lemon yellow discoloration of the secretion. If the blood is intimately mixed with mucus, the hemorrhage is confined to the cervical mucous membrane, as in recent catarrh or polyps; or when corporeal hemorrhage is accompanied by an abundant secretion of mucus by the cervix, as in endometritis, the hemorrhages of pregnancy, and subinvolution after abortion and parturition. Inspissated blood of syrupy consistency is observed when the blood has been retained for some time in a closed cavity, as in hematocolpos and hematometra; true coagulation does not take place under these circumstances. Shreds of tissue in the blood point to degenerated neoplasms, or exfoliation and disintegration of portions of the mucous membrane, especially in cases of abortion with infection.

The Causes of Amenorrhea.

Definition and Limitations of Amenorrhea. — Amenorrhea is the absence of menstruation in a sexually mature woman. In a wider sense the term should embrace all cases of amenorrhea, including those in which the menses are merely suppressed for one or two periods by temporary causes such as exposure to cold affecting the abdomen, emotion and the like. These are mere temporary conditions, however, and the physician is rarely called upon to determine their cause. The forms of amenorrhea which are brought to the physician's attention as such are always chronic conditions in which menstruation has been interrupted at least for several months. Amenorrhea in addition includes delayed menstruation and premature cessation of the menses. As menstruation usually continues so long as the ovarian function is preserved, any failure of menstruation during the period when ovulation is active must be regarded as abnormal. In the absence of clinical signs of ovulation we must fall back on our knowledge of the normal time of the first appearance of menstruation and of the menopause, which varies between fairly wide limits. Accordingly the physician is not often called upon to assign a cause for amenorrhea before the 20th or after the 40th year of life. For practical purposes these ages must be regarded as marking the limits of pathologic amenorrhea. Abnormal scanty menstruation, for which the patient often consults the physician in the absence of other symptoms and particularly if it is associated with sterility, is practically equivalent to amenorrhea in a climacteric and etiologic sense. The boundary line between scanty and abnormally scanty menstruation is difficult to determine, unless the patient states that the menstrual flow has perceptibly diminished.

Definition and Limitations of Amenorrhea.

Since amenorrhea signifies the complete absence of menstrual bleeding, atresia of the genital organs, in which the blood is merely retained, are here excluded from the diagnosis.

The diagnosis of amenorrhea is based exclusively on the patient's statement that menstruation has failed to appear.

The physician's duty consists solely in finding the **cause of the amenorrhea.** He is consulted because the patient wishes to know the reason why menstruation has not appeared or on account of symptoms which are the result of amenorrhea (flushing, molimina, eczema), or sterility, or certain symptoms of the general disease which is the cause of the existing amenorrhea. Not infrequently

Causes of Amenorrhea.

amenorrhea gives the first hint of such a general disease. Various difficulties are encountered in searching for the cause of amenorrhea. In some cases the cause is obvious as, for example, when the uterus is imperfectly developed; in other cases the diagnosis may remain in doubt after the most careful examination of the genitalia and of the entire body and the most careful weighing of all possible causes. The prognosis and treatment of amenorrhea depend solely on the correct recognition of the causes. These may be divided into local, *i.e.*, such as reside in diseases and alterations of the genital apparatus, and general, *i.e.*, causes which merely impair the menstrual function, such as wasting diseases, nutritional disturbances and profound neuroses. It must be admitted that this distinction cannot be carried out in all cases. In general infectious disease, for example, there may be a question whether the debilitating effect of the disease is the cause of the amenorrhea, or some local disease of the uterine mucous membrane has developed as a result of the infection and is interrupting the normal process of menstruation. In order to lay down the indications for successful treatment it is absolutely necessary, and in most cases it is also possible, to recognize or at least to exclude the local causes.

It must be remembered that uterus and ovaries are necessary for normal menstruation; in diseases of either organ **local causes** may be present. Types of these two forms are seen in amenorrhea after extirpation of the uterus and after oöphorectomy. The physiologic amenorrhea of pregnancy and lactation will be omitted from the discussion.

In the examination of the genitalia for the purpose of finding the local causes attention should be directed first to the uterus. By bimanual palpation we determine whether there is a uterus, and if so, its size and thickness. The absence of a uterus or the presence of a rudimentary uterus is a certain cause of amenorrhea, even if the ovaries are perfectly normal. On the other hand, if the uterus is found to be present, the sound should be introduced into the cavity for the purpose of determining its length and, with the external hand feeling for the head of the sound through the abdomen, the thickness of the uterine wall. Great care is necessary as the atrophic wall is easily perforated. Atrophy of the uterus is recognized by comparing the uterine cavity with the thickness of the wall. Two forms of atrophy are distinguished: in one the cavity is greatly shortened and the wall attenuated (concentric atrophy), in the other the cavity is of normal length but the wall is thin (eccentric atrophy). The former usually indicates severe atrophy with persistent amenorrhea, while the latter is generally a temporary condition.

Uterine Amenorrhea.

It is not always easy to determine whether the uterine atrophy is primary or secondary to atrophy of the ovaries. So-called fetal uterus

and infantile uterus, in which menstruation has never taken place, may be regarded as primary atrophy; while those cases which develop after menstruation has been going on for a variable length of time may be due to some primary disease of the uterus or may be secondary. In these cases atrophy is usually less severe and often of the eccentric type. Some information may be obtained by examining the uterus and ovaries. If sounding the cavity shows it to be atrophic and partially obliterated, the local cause may be found in destruction and adhesions of the endometrium, such as occur after infectious puerperal processes, after the use of caustics, and after curettage, particularly during the puerperium. If the cavity is open, the loss of the uterine function must still be regarded as the cause of the amenorrhea, even if the ovaries are found on examination to be normal (see below); this type of amenorrhea occasionally occurs in endometritis and chronic metritis. The uterine atrophy which occasionally develops in the presence of large puerperal exudates is also local in character. In not a few cases, however, and especially if no general cause can be found, it must remain undecided whether the uterine amenorrhea is primary or not. From the therapeutic standpoint it is better to regard it as a local uterine atrophy and to treat it accordingly by local measures.

If no cause for the amenorrhea can be found in the uterus, the ovaries are examined, if necessary under anesthesia. The size is the only criterion that we have for their integrity. If they are normal in size, it is not likely that they are the cause of the amenorrhea. On the other hand, mere diminution in size is no proof that the alteration is primary; since atrophy of the ovaries follows uterine atrophy, both the primary form and that which depends on constitutional causes. Primary atrophy of the ovaries from local causes is very rare. In most cases some constitutional cause or internal disease which we are not always able to identify is present. Amenorrhea of purely ovarian origin is occasionally observed in the presence of bilateral, and especially malignant ovarian tumors, when associated with complete destruction of the essential ovarian tissue. It is also seen at times in chronic oöphoritis with atrophy of the follicles. The molimina may help to decide whether an amenorrhea is ovarian or not. They consist in dragging and cramp-like pains in the two hypogastric regions and in the sacrum, which last several days and recur either every four weeks or at irregular intervals, when ovulation is normal and the menstrual congestion is not sufficient to produce a flow of blood. If the molimina are well marked, the case is usually one of primary uterine atrophy.

Ovarian Amenorrhea.

Case 42. Miss H., age 18; has never menstruated. She says that for the past two years she has suffered very severe dragging and cramp-like pains in the abdomen occurring at quite irregular intervals. For the past four or five months these pains have occurred reg-

ularly every four weeks, lasting from 6 to 8 days and increasing in intensity often to the point of syncope. During this time the patient is entirely incapacitated. Examination of the genitalia shows entire absence of the vagina and a very thin, rudimentary, bipartite uterus. The right ovary is normal in size; the left is somewhat smaller (see Fig. 326).

CASE 43. Miss L., 19 years of age. First menstruation at the age of 13; menstruation comes on regularly every 4 weeks, lasting from 2 to 3 days, and the quantity is normal. Several years ago the patient caught a severe cold by wading in cold water during the menstrual period; this was followed by suppression of the menses and complete amenorrhea lasting 18 months. The menses then reappeared and have since then been irregular, sometimes coming on too early and sometimes too late, or with intervals sometimes as long as 4 months. A few drops of blood were discharged and there was severe dysmenorrhea whenever menstruation failed to appear, and the patient had severe molimina, consisting of cramp in the abdomen and headache. Examination revealed a uterus 4½ cm. in length and of normal shape, with very thin walls; both ovaries could be felt and were smaller than normal.

Absence of molimina does not always prove that the ovaries have ceased to functionate, as may be frequently observed after hysterectomies in which portions of the ovaries are left behind.

Amenorrhea due to **general and constitutional causes** is much more frequent and of greater practical importance. If on combined examination no very marked local changes are found, the entire body must be examined and the cause of the amenorrhea will be found in general diseases much more frequently than is generally supposed. It must be remembered, however, that these diseases and nutritional disturbances are not the direct cause of the interruption of the process of menstruation. They merely produce atrophy of the ovaries, which is often followed by secondary atrophy of the uterus. Hence the local signs may be exactly the same in such cases as in amenorrhea due to local causes (see above). In these cases also the severity of the process may be judged in part by the difference between concentric and eccentric atrophy.

General Causes.

The following groups of diseases may cause amenorrhea:

1. Infectious diseases which interfere with ovulation until far into convalescence. Amenorrhea is most frequent after typhoid fever and is also observed after cholera, scarlet fever, etc.

2. Organic or general diseases due to chronic infection or other external injuries, such as pulmonary tuberculosis, syphilis, cancerous cachexia, leukemia and nephritis. The woman's general health is weakened and she is injured in her most vital part, ovulation.

3. A group of metabolic and constitutional diseases of obscure etiology also interfere with maturation of the follicles. They are diabetes, myxedema, acromegaly, exophthalmic goitre, Addison's disease, and chlorosis.

4. Poisoning with drugs, or other substances taken in excessive quantities, such as morphin, opium, mercury, phenacetin (Olshausen) and alcohol. Amenorrhea following poisoning with arsenic and phosphorus is probably local in character, due to destruction of the ovaries.

5. Severe psychic influences, such as fright, violent excitement, or psychic diseases, especially progressive paralysis. I have seen two cases belonging to this category.

Case 44. Mrs. S., age 21. First menses at the age of 16; regular every four weeks, lasting three days, scanty; last menses 15 months ago. Examination reveals a small uterus (length as determined by the sound, 5 cm.) and a small ovary on each side. The internal organs are normal and no physical cause of amenorrhea is given in the history. The neurologist's diagnosis of the patient's mentality is congenital imbecility, possibly with dementia praecox.

Case 45. Mrs. W., age 44. First menstruation at the age of 20; regular every month, lasting 4 to 5 days; last menses 8 months ago. Examination of the genitalia reveals a small uterus (length of cavity 6 cm.) and small ovaries. No internal cause can be found for the amenorrhea. The neurologist's examination of the mental condition reveals a severe melancholy which has been increasing for the past year.

(It cannot be decided whether in each of the above groups, and particularly in the case of the 1st and 2nd, the amenorrhea is due to organic diseases of the ovaries or merely to abolition of the follicular activity.)

Aside from these conditions all kinds of causes which produce a temporary or permanent weakening of the body may arrest ovulation and thereby produce amenorrhea. These include anemia after severe hemorrhage, especially during parturition, which may also injure the uterine function directly.

Case 46. Mrs. M., age 30 years. First menstruation at the age of 15; regular every four weeks, lasting 8 days; profuse. Married at the age of 17; has had four viable children, the last 8 years ago. Three years ago abortion, accompanied by profuse hemorrhage, after which she was confined to her bed for four months on account of persistent hemorrhages. After this menstruation recurred regularly four times, and since then there has been complete amenorrhea; molimina are absent. The internal organs show no cause for the amenorrhea. The uterus is 7 cm. long; the wall thinner than normal; both ovaries are of normal size.

Long-continued and exhausting lactation may lead to amenorrhea long after the child has been weaned; also change of residence or occupation, when the change is an unfavorable one, from good hygienic surroundings to a debilitating mode of life, or the occupation is changed from physical work to which the woman is accustomed to severe mental exertion. The amenorrhea which is observed among young women training to become mid-wives belongs to this type; I have frequently observed this in Berlin in young girls from the country.

Case 47. Mrs. N., age 20. First menstruation at the age of 13; regular. This is the third time the patient has had total amenorrhea immediately after coming to Berlin. The first time it lasted three months, the second time two months, and this time six weeks, while in her own home menstruation is always regular, although somewhat scanty. Molimina are absent. Examination shows that the uterine wall is attenuated; length of the cavity 7 cm.; both ovaries distinctly palpable.

Amenorrhea occurring in women with urinary fistulae, the etiology of which is still obscure, and the amenorrhea which occasionally

follows parturition in the absence of hemorrhage, infection or lactation also belong to this group. The association of general obesity with amenorrhea has never been explained. While on the one hand obesity develops in persons who are sterile, without any sexual desire and who gradually become amenorrheic, and is probably due in these cases to insufficient oxidation resulting from the abolition of the ovarian function; there are also cases in which obesity is undoubtedly the primary disease, and if it is relieved, normal menstruation reappears.

The above-mentioned conditions are positive causes of amenorrhea, and others will no doubt be discovered as our knowledge becomes more complete. Finally, it must be mentioned that in not a few cases the cause of amenorrhea cannot be discovered, and one must be content with the theory of a premature menopause.

The Causes of Dysmenorrhea.

Definition. Dysmenorrhea signifies painful menstruation. It does not represent a disease nor a pathologic conception. It is merely a symptom and may occur in diseases of the genital organs, such as endometritis, myoma, diseases of the tubes. Accordingly the discussion of dysmenorrhea properly belongs to the symptomatology of these diseases, but I shall make the diagnosis of the causes of these symptoms the subject of a special chapter because it is often the only, or at least the most prominent, symptom complained of by the patient when she consults the physician. Another reason for doing so is that there are a number of separate forms of dysmenorrhea that are not characterized by definite and easily recognized physical signs, and depend on certain organic nervous changes which are difficult to detect. In daily practice the physician is tempted by the difficulty of recognizing these causes to content himself with a diagnosis of dysmenorrhea, but in giving such a diagnosis he is merely repeating under a high-sounding name the symptom which the patient has just described. 'Dysmenorrhea' as a diagnosis has no place in scientific gynecology, and it is the physician's duty to ferret out the anatomic or at least the functional changes which explain the painful course of the menstrual process. Unfortunately this is not always possible, and from this standpoint I consider the diagnosis of dysmenorrhea one of the most difficult problems presented in gynecologic diagnosis.

Definition.

It is important to remember in the first place that the menstrual process is not confined to the uterus and ovaries. All the organs contained in the true pelvis are more or less involved in the premenstrual congestion, and a number of more or less severe psychic changes take place in those organs which have a plentiful nerve supply, as the stomach, intestine, heart, and in the peripheral nerves of the head, because the central and peripheral nervous systems also take part in the process. Accordingly dysmenorrhea ought to include functional disturbances in remote organs and alterations of the psychic state; but the term is not generally used in that way, being limited to painful conditions of the pelvic organs. I shall therefore confine myself to the analysis of these conditions.

Normal menstruation ought to run its course without any painful sensation beyond a feeling of heaviness in the abdominal organs and a slight painful pressure associated with a dragging sensation in the

sacrum or to either side. Any painful sensation during menstruation is designated dysmenorrhea and must have a special cause. Pain is always a subjective symptom and individuals vary in their conception and toleration of it; hence women of good resistance may be barely conscious of dysmenorrhea, while delicate, sensitive persons suffer intense pain with the same objective changes. Nevertheless the degree of pain is the only criterion we have for the severity of the dysmenorrhea. If a patient consults a physician on account of dysmenorrhea, it is a proof that the pain which she feels is too strong for her; hence a dysmenorrhea that induces a patient to consult a physician is always pathologic.

In order to understand dysmenorrhea it is necessary to be familiar with the course of the menstrual process and the extent to which the various genital organs take part in it. Menstruation begins with maturation of the Graafian follicle in the ovary; the follicle gradually fills up, reaches the surface and ruptures, and this process, which is confined to the ovary, reflexly produces marked dilatation and engorgement of the vessels in the pelvic organs. The most marked effect is observed in the uterus; the uterine tissue becomes thicker and more rigid, and the entire organ lengthens out. The blood-vessels of the uterine mucosa become engorged; extravasations of blood into the upper layers of the greatly swollen mucous membrane take place and gradually cause separation of the epithelium, finally escaping as menstrual blood. The blood collects in moderate quantities in the uterine cavity and escapes through the cervix. The bleeding is accompanied by a decrease of the swelling, the epithelium regenerates, and in the course of a few days the mucosa regains its normal state. The tubes become thicker during menstruation by swelling of the mucous lining and, to a certain extent, of the muscularis. Rarely bleeding takes place into the lumen of the tube. The congestion also affects the ovaries and is probably the direct cause of the rupture of the follicles. The vagina, the pelvic peritoneum and, to a limited extent, the pelvic connective tissue also take part in the hyperemia. Menstrual congestion begins about eight or ten days before the flow, increasing gradually, and produces the most marked changes immediately before the blood begins to escape; it usually diminishes during the course of the bleeding and the vessels regain their normal vascularity soon after the flow has ceased. In order that the menstrual process shall run a painless course it is therefore necessary that nothing interfere with maturation and rupture of the follicles; that the congestion in the uterine wall do not meet with resistance from infiltration of the tissues; that the mucosa be capable of swelling and taking up the extravasated blood; that the size of the uterine cavity be sufficient to accommodate the swollen mucous

The Normal Menstrual Process.

membrane; that the menstrual blood escape readily from the cervix; and that the congestion of the tubes and of the peritoneum take place in the normal tissues. In addition the nervous system must possess a normal degree of irritability and the psychic functions must be normal, otherwise the slight alterations which take place in the nervous system during normal menstruation may be abnormally exaggerated.

Classification. It is obvious that the classification of dysmenorrhea must take account of the manner in which the various organs take part in the process. Accordingly we have ovarian, tubal, uterine, and nervous dysmenorrhea; the last form finds its explanation solely in overexcitement of the nervous system without any objective changes. Classification.

Although the peritoneum and parametrium also take part in the menstrual process, it is not necessary to make a separate classification of peritoneal and parametrial dysmenorrhea, because the menstrual pain which has its origin in these structures is nothing more than an increase produced by the premenstrual congestion of pains due to adhesive and exudative chronic pelvic peritonitis, and parametritis with contraction. Women suffering from these diseases are rarely free from pain at any time, and if they suffer only at the time of menstruation, the dysmenorrhea is so slight that they do not even consult a physician. Severe dysmenorrhea always originates in the organs themselves.

A careful bimanual examination of the genital organs is necessary to determine the origin of this organic dysmenorrhea, which must have a definite objective cause. Simple **ovarian dysmenorrhea** is rare. It occurs in a mild form with chronic oöphoritis as a dragging, stabbing, gnawing, boring pain or pressure in the region of the affected ovary, frequently radiating into the hips or legs. In most cases it is merely a menstrual exacerbation of the pain which is constantly present; but occasionally it is a pure dysmenorrhea. It usually appears a few days before menstruation. The cause of a pure ovarian dysmenorrhea is occasionally found in hemorrhages into the parenchyma of the ovaries, especially the follicles (haematoma ovarii). The ovaries appear greatly enlarged, rough on the surface, and occasionally attain the size of a child's head. Instead of a simple dysmenorrhea, constant pain, becoming aggravated during menstruation, may be present in these diseases. I have seen a well marked form of pure ovarian dysmenorrhea in cases of ovarian tumor with quite recent torsion. The dysmenorrhea began shortly before the menstrual period, was always very severe, and manifested itself in cramp-like pains, chiefly confined to the affected side of the abdomen. These women sought relief merely for the dysmenorrhea and felt perfectly well during the intermenstrual interval. In every case I have found an ovarian tumor, Ovarian Dysmenorrhea.

usually a small one, with quite recent torsion of the pedicle and with adhesions. In some of the cases hemorrhages had taken place into the tumor. After extirpation the patients were relieved from their dysmenorrhea.

CASE 48. Mrs. St., 25 years old. First menstruation at the age of 17; always regular and painless; has been confined three times. For the past four months violent, boring, cramp-like pains in the left hypogastric region, appearing a week before menstruation and disappearing with the cessation of the flow; no intermenstrual symptoms. At the operation the uterus was found in retroversion, and on the left side a very movable ovarian tumor the size of a child's head, with a twisted pedicle and no adhesions.

A positive diagnosis of ovarian dysmenorrhea always presupposes the presence of palpable changes in the ovary. The disease described by Olshausen as neuralgia of the ovary and dysmenorrhea occurring in cases of hypoplasia of the uterus, and attributed by Schauta to the changes in the ovary, are doubtful types of ovarian dysmenorrhea.

Simple **tubal dysmenorrhea** is not uncommon and almost exclusively accompanies chronic salpingitis or its sequelæ. In cases of recent inflammation the symptoms, which are quite severe before and during the period, are merely menstrual exaggerations of the pain which is constantly present; in chronic salpingitis the clinical picture is much more like that of dysmenorrhea. The pain is not characteristic and occurs chiefly before the periods; it is described as a dragging, sticking, stabbing or burning sensation in the side; it is therefore necessary for making a diagnosis of tubal dysmenorrhea to demonstrate distinct changes in the tube by palpation. In some cases the tubal pain is associated with true 'cramps'; these cramps as a rule do not originate in the tube, as that structure is no longer capable of active contraction, but are derived from the uterus which, without being itself diseased, reacts to the premenstrual congestion with labor pains.

Tubal Dysmenorrhea.

In chronic inflammatory conditions localized simultaneously in the uterus, adnexa, connective tissue and peritoneum, it is difficult to determine how much each organ participates in the process. The premenstrual congestion causes pain in various areas at the same time, and this form accordingly is also called congestive or inflammatory dysmenorrhea.

From the standpoint of frequency and severity **uterine dysmenorrhea** is much more important than the forms so far described. Uterine pain is caused by contraction of the uterine muscle, known as labor pains. Since uterine contractions rarely occur when menstruation is normal, and the mild contractions of a healthy organ are not felt as pains if the nervous system is in good condition, there must be some abnormality which is the reflex cause of the painful contractions during dysmenorrhea. Pain occurs when the menstrual blood

Uterine Dysmenorrhea.

accumulates in the uterine cavity in connection with inflammations of the endometrium and metritis, in imperfectly developed uteri with contracted cavities and contracted blood-vessels in response to the forcible stimulus of the menstrual wave; it may be reflex in the presence of hyperesthesia of the endometrium in irritable, nervous individuals, even when the menstrual process is anatomically normal. Painful contractions or uterine pains are common to all forms of uterine dysmenorrhea of whatsoever origin. Uterine dysmenorrhea may be due to a great many causes, the recognition of which is exceedingly difficult and by no means possible in every case. There are two methods of making a diagnosis and both are useful; they are examination and interrogation of the patient.

By objective examination we first try to find out whether the uterus is the seat of the dysmenorrhea. This may be done by exclusion if the tubes and ovaries are healthy. It is difficult to find positive signs in the uterus because many cases of uterine dysmenorrhea are without any abnormal physical signs, *e.g.*, all those which depend on endometritis and stenosis; on the other hand, the localization of the pain in the uterus is usually so definite as to dispel all doubt in regard to the seat of the dysmenorrhea. The patients often state that they feel the pain as jerky, rhythmical contractions resembling labor pains. Others describe it as a cramp-like sensation or pressure deep down in the middle of the pelvis, a feeling as though they had a 'stone' in the abdomen. Some women are less definite in their statements and complain of drawing pains in the sacrum radiating into both thighs; others again refer the uterine pain higher up into the abdomen around the umbilicus or under the arch of the ribs. After the uterine character of the dysmenorrhea has been established, objective changes may be found in some cases to explain the disease. Some of these changes are easily recognized, such as submucous myomata, acute-angled anteflexion and retroflexion in nulliparous women, chronic metritis, or well marked hypoplasia. These are exceptional, however; in most cases of uterine dysmenorrhea the palpatory findings are normal. Further information may be obtained by introducing the sound, which may reveal stenosis at the internal os or sensitiveness of the endometrium.

From the history we learn, in addition to localization of the pain, whether the first attack of dysmenorrhea occurred either with the first menstruation or at some later period of the patient's life; whether the dysmenorrhea begins a few hours or a few days before the menstrual flow or follows the flow; whether it is present only during the first few hours or lasts several days and whether it recurs during the course of menstruation; whether the dysmenorrhea accompanies every menstruation or not and, if possible, the causes of its appearance or non-

appearance and its severity; the effect on dysmenorrhea of marriage, parturition, mode of life and occupation and of therapeutic measures. The information to be obtained by a careful interrogation of the patient may be exceedingly valuable to the experienced diagnostician.

Mechanical dysmenorrhea occurrs when there is an obstruction to the flow of menstrual blood with an accumulation of the blood in the uterine cavity, producing reflex contractions of the muscles which expel the blood. If we adhere strictly to the definition of mechanical disturbance and exclude all those cases, especially in irritable individuals, in which the presence of blood alone in the cavity produces reflex contractions, the mechanical form of dysmenorrhea presupposes a stenosis of the cervical canal sufficient to prevent the passage of blood even in the finest stream. But since it is not probable that a normally formed uterus is ever the seat of a stenosis sufficient to prevent the passage of blood corpuscles, we must look for other contributory causes, such as the abnormally rapid secretion of large quantities of menstrual blood which cannot escape fast enough and, by accumulating in the cavity, produces reflex contractions; or the admixture of clots or particles of tissue which have difficulty in passing the inner os in nulliparous women. The last category includes many cases of exfoliative endometritis (dysmenorrhea membranacea) in which uterine contractions are produced by extrusion of the membranes. The most important factor in the production of a stenosis is the congestive swelling of the uterine mucous membrane, bringing the walls of the canal in close contact and effectually preventing the passage of blood; nevertheless it is necessary to demonstrate that a stenosis is present before making a positive diagnosis of mechanical dysmenorrhea. Stenoses at the external os are much easier to recognize than any others and usually do not cause dysmenorrhea. I have occasionally seen collections of menstrual blood behind the external os sufficient to cause actual ballooning of the cervix without the least pain. Stenoses of the internal os, which are much more important, are recognized by the inability to introduce a sound with a knob 2 mm. thick through the internal os. It must be borne in mind, however, that the sound merely recognizes narrowing of the cervical tissue, and readily forces its way through folds of mucous membrane that may be in contact with one another; hence the absence of obstruction to the sound at the internal os does not positively exclude stenosis due to swelling of the mucous membrane. Stenoses of the body of the uterus are rare. One indubitable case of this kind has, however, been reported by Olshausen, hence the possibility of corporeal stenosis must be borne in mind.

Mechanical Dysmenorrhea.

A variable degree of anteflexion is very often found in the dysmenorrhea of nulliparous women and virgins. This may undoubt-

edly produce stenosis of the uterine canal by angulation at the internal os and, as the sound is apt to become arrested at this point unless the examiner has mastered the manipulations necessary for its introduction, the diagnosis of mechanical dysmenorrhea appears to be justified. But this is by no means the case. A moderate degree of angulation is overcome by the extension and stiffening of the organ which takes place during menstruation, or the tissue around the internal os may be quite flaccid and offer no real obstacle to the escape of the menstrual blood. It is to be remembered also that an anteflexion may be combined with other conditions which are the true cause of dysmenorrhea; thus, a hypoplastic uterus is often anteflexed; in endometritis and posterior parametritis there may be a marked secondary anteflexion, and these conditions are the true causes of the dysmenorrhea. It is obvious also that nervous dysmenorrhea may occur with anteflexion. Hence, before a diagnosis of mechanical dysmenorrhea due to anteflexion can be made, these other much more frequent causes must be excluded; in other words, we must have in a person who is neither nervous nor hysterical a freely movable, normally developed uterus in permanent rigid anteflexion.

In view of this uncertainty of the diagnosis of mechanical dysmenorrhea it is essential to find some support in the history. As mechanical dysmenorrhea depends on congenital changes it occurs early, at least during the first years of sexual life, if not at the first menstruation. A characteristic feature is that the dysmenorrhea always occurs not more than a few hours—never several days—before the menstrual flow, and that the pain almost always subsides as the flow becomes more abundant and does not return during menstruation unless the flow of blood is again arrested. This form of dysmenorrhea is but rarely influenced by regular coitus, while it usually disappears altogether after the birth of the first child. If dilatation with metal dilators proves permanently successful, it indicates that the dysmenorrhea was due to mechanical causes. I have not infrequently seen a temporary benefit in endometritic dysmenorrhea also; but it is evident that this does not necessarily exclude a mechanical obstacle, since there is nothing to prevent its return after it has once been removed.

A not infrequent form of dysmenorrhea is observed with imperfect development of the uterus. Assuming that the ovarian function is normal, this form of dysmenorrhea may be explained by reflex contractions due to increased pressure in the uterine vessels, the increased pressure being due to the fact that the vessels are too small to allow for the accumulation of blood, and the cavity too narrow to permit the necessary degree of swelling of the mucous membrane. Instead of a true men-

Dysmenorrhea with Imperfect Development of the Uterus.

struation there is merely a periodic congestion in the tissues, and the menstrual flow, at least in the beginning, is very scanty. The diagnosis is based chiefly on the abnormal uterus as recognized by palpation and the sound. Every grade from extreme hypoplasia to a merely undersized virginal uterus, capable of conception and normal parturition, is seen in this form of dysmenorrhea, which often disappears after marriage or the first conception. Curiously enough its appearance is often delayed several years after the establishment of sexual maturity, as the menstrual congestion gradually becomes more profuse, and it is almost never felt after marriage. The bleeding is very scanty, beginning with only a few drops. The smaller the flow, the more severe the dysmenorrhea. The pain usually begins several days before the appearance of the blood, coincident with the beginning of the premenstrual congestion; increases steadily until the bleeding begins; and usually diminishes when the flow has attained its normal strength, or ceases altogether. The pain may recur if the flow is interrupted. As deficient development of the genitalia is often part of a general underdevelopment associated with diminished bodily and nervous resistance, the latter is often a factor in the etiology of this form of dysmenorrhea.

Another case of severe dysmenorrhea is found in inflammatory changes of the endometrium. The diagnosis of this endometritic dysmenorrhea, which is characterized anatomically in some cases by interstitial exudations, rarely by marked glandular changes, is quite easy if the dysmenorrhea is associated with menorrhagia; but in the simple forms of severe endometritic dysmenorrhea there is often a total absence of symptoms referable to the endometrium, such as leucorrhea and hemorrhage, and only occasionally nervous phenomena referable to the head and stomach. The diagnosis in such cases must be made solely by means of the sound (see p. 508). Irregularities are found at the fundus (endometritis fundi) and at the intersections of the tubes; the endometrium is extremely painful to the touch, particularly where the surface is uneven. The history and symptomatology are in many respects quite characteristic. Endometritic dysmenorrhea usually occurs from 8 to 10 days before the flow (coinciding with the beginning of the premenstrual congestion); occasionally the pain and the bleeding begin at the same time, and as a rule the dysmenorrhea continues during the entire period. The flow is normal and if anything increased in quantity, rarely diminished. As this form of dysmenorrhea is usually acquired it makes its appearance late; any dysmenorrhea beginning after marriage may, as a rule, be regarded as inflammatory. Nevertheless a dysmenorrhea which has existed since the first menstruation may be found in young women and often in virgins to be due to severe structural changes. Thus in the

Endometritic Dysmenorrhea.

case of a virgin the cause of dysmenorrhea was found in a severe endometritis which at each menstruation was accompanied by the exfoliation of thick pieces of membrane. Hence the fact that a dysmenorrhea began before marriage is no argument against its inflammatory character. It is often difficult to decide whether it is primary or secondary, or both conditions are due to a common cause, such as masturbation.

Besides this form of dysmenorrhea, which is due to inflammatory changes in the endometrium, there is another variety in which the same sensitiveness of the uterine mucous membrane is present without other nervous phenomena and without any demonstrable structural changes. The sound does not show any roughening of the surface, and in many cases the only objective change is a slight obstruction at the internal os caused by a fold of membrane which is exceedingly sensitive to the touch. The condition may be designated hyperesthesia of the endometrium. Theilhaber attributes it to spasm at the internal os.

In one sense nervous dysmenorrhea also belongs to the uterine varieties because, in contradistinction to tubal and ovarian dysmenorrhea, it manifests itself in the uterus; but it differs very materially from genuine uterine dysmenorrhea by the fact that it is due to changes in the central nervous system and not to changes or abnormality of the uterus. In this form also the pain is caused by uterine contractions which, however, are not excited by any abnormality of the uterus but are rather the effects of unusual reflex excitability on the part of the uterine nerves and, owing to the morbid condition of the nervous system, are felt as painful sensations. This type of dysmenorrhea occurs in women with pronounced hysterical and neurasthenic symptoms, and also in the absence of such symptoms in excitable, so-called nervous individuals or in some whose nutrition is bad and who suffer from anemia or general debility. Accordingly this form usually occurs in city girls employed in industrial establishments, whose work is physically exhausting and who, in addition, overwork their brains; in girls who have been spoiled by their education both physically and mentally; and in childless women struggling under unhappy domestic conditions. The diagnosis of this very frequent form of dysmenorrhea is made by excluding all local abnormalities of the uterus that are known to be causes of dysmenorrhea, and by the presence of disease or weakness of the central nervous system.

Nervous Dysmenorrhea.

A special form of dysmenorrhea has been classified by Schiff and Fliess under the name of **nasal dysmenorrhea.** The pain is caused by painful contractions of the uterus excited by irritation of certain definite areas on the nasal mucous membrane, at the tuberculum septi and

the anterior extremity of the inferior turbinate. Indeed it has been demonstrated beyond a doubt that this form of dysmenorrhea can be temporarily, and sometimes even permanently, cured by cocainizing and cauterizing these areas. Nevertheless the effect of the treatment is open to various explanations. As yet the existence of a simple nasal form of dysmenorrhea cannot be said to be proven.

Nasal Dysmenorrhea.

The following **method** may be pursued in the investigation of a case of dysmenorrhea. By interrogating the patient, the seat, duration and severity of the dysmenorrhea, the time of its first appearance and its relation to the menstrual flow, the effect of marriage, parturition and any local or general methods of treatment are ascertained. A local examination is then made, except in the case of virgins. If, however, both a nervous etiology and developmental disturbances can be definitely excluded, and a careful study of the patient's general constitution and the symptoms seem to indicate the presence of a mechanical obstacle, an examination is indispensable, particularly as local treatment will have to be applied. The examination should be made under anesthesia.

The dysmenorrhea which is so extremely common in young girls may be due to a variety of causes. Insufficient development of the uterus and a slight stenosis at the internal os are the causes in some cases; while chlorosis and insufficient bodily development, associated with mental overexertion, are responsible for others. Hence these forms of dysmenorrhea are amenable to different kinds of treatment.

By combined examination we determine whether the tubes and ovaries are the seat of changes capable of producing dysmenorrhea. If these organs are normal, or if the seat of the pain and its character at once point to the uterus as the seat of the dysmenorrhea, that organ should be subjected to careful scrutiny. First the degree of development is noted. If the uterus is of normal size and the width of the cavity, as determined with the sound, is found to be normal, hypoplasia may be excluded; while, on the other hand, a distinct diminution in the size suggests a dysmenorrhea due to arrested development. The sound is then introduced in order to search for any mechanical disturbance. The instrument must be handled very lightly, especially at the internal os, the width of which and any hyperesthesia of the mucous membrane must be carefully noted. If no objective changes are found, the corporeal mucous membrane is investigated for sensitiveness and inequalities. If the results of objective examination are absolutely negative, the nervous system is examined and the history completed by inquiring into the daily occupation, domestic surroundings, worries and the like. If neither the objective examination nor a careful study of the history clears up the case, some clue may be gained by observing the patient during treatment. One or two days before the beginning of menstruation the internal os is sounded or dilated; if this is not followed

by improvement, the presence of a mechanical obstacle may be definitely excluded from the diagnosis. If, on the other hand, the dysmenorrhea is relieved, the cause is probably mechanical. If the dilatation is followed by temporary improvement, the cause may still be found either in inflammation or developmental disturbances; for this type of dysmenorrhea is also susceptible of improvement by dilatation. In many cases the diagnosis cannot be cleared up until the patient has been under observation for some time.

Causes of Sterility.

Definition. Sterility is the inability of an individual to produce progeny. Accordingly a man is called sterile when he is incapable of fertilizing a female ovum, and a woman when she cannot furnish an ovum that is capable of impregnation, or cannot bring a normal ovum to the seat where impregnation takes place, or cannot provide the necessary conditions for the further development of the impregnated ovum. But the physician who is called upon to determine the cause of sterility has to deal not with a sterile man or a sterile woman, but with a sterile marriage. While laymen usually apply the term sterility to a marriage that does not result in the production of living or viable progeny, and accordingly include under the term sterility those cases in which the fetus is destroyed by habitual abortion, the physician must distinguish clearly between the two conditions, although the result in both is the same so far as the marriage is concerned; for in the latter all the conditions for a normal conception are present, while in the former they are absent. From the medical standpoint sterility is present when conception does not occur, or, if the ovum is impregnated, when it fails to become embedded. A marriage in which the ovum becomes impregnated and imbedded is not called sterile. Clinically it is difficult to distinguish between the two conditions, however, as habitual abortion may occur very early.

Definition.

It is equally difficult to name a time when a marriage may be regarded as sterile. Observations by Simpson show that it is exceptional for the first child to be born after the fourth year of marriage, and in a scientific sense a marriage may therefore be called sterile after that period. But the subsequent birth of a child is by no means impossible even if the sterility has not been specially treated. In actual practice, however, the observation has merely a prognostic value, as people lose patience long before the expiration of the four years and demand an answer to the question why their marriage continues childless.

For practical purposes it is advisable to distinguish between absolute and relative sterility. The former is a condition in which pregnancy is absolutely impossible as in the case of a rudimentary uterus; while relative sterility refers to conditions which only interfere with the act of conception, such as a stenosis at the external os. A distinction between primary and secondary sterility is also of diagnostic value. A marriage is called primarily sterile when pregnancy does not take place at all, while in secondary sterility the birth of the

first child is not followed by subsequent pregnancies because one of the parents becomes diseased.

The general practitioner is quite often called upon to determine the cause of sterility. As a rule the husband sends his wife for examination because he takes it for granted that she must be the cause of the sterility, or the wife comes of her own accord under the same impression and in the desire to remove any obstruction to conjugal happiness. The physician is thus easily tempted to devote his attention chiefly to the wife and to neglect the husband, a practice which is quite erroneous, as our views on this question have undergone considerable modification to the disadvantage of the husband.

By examination of the semen it has been shown that the husband may be responsible for the sterility. We recognize several abnormal conditions. In azoöspermia the semen ejaculated during coitus is entirely devoid of spermatozoa. In oligospermia the semen contains only a few spermatozoa with diminished motility (although theoretically conception is possible under these circumstances, there is practically no difference between azoöspermia and oligospermia). Finally, there is a third condition, so-called necrospermia, in which the semen contains normal spermatozoa almost or quite incapable of movement. How this condition is responsible for sterility is not very well understood.

The following table shows to what extent the male may be responsible for a sterile marriage.

Kehrer: Among	96	cases	azoöspermia	was	found	in	30 per cent.,	oligospermia	in 11 per cent.
Lier and Ascher	" 132	"	"	"	"	"	32 per cent.		
Schenk	" 110	"	"	"	"	"	33 per cent.,	"	12 per cent.
Knorr	" 72	"	"	"	"	"	25 per cent.,	"	25 per cent.

The results of these investigators, which are fairly uniform, indicate that the male is the true cause of sterility in one-fourth to one-third or, if the cases of oligospermia are included, in almost one-half of all the cases.

These facts have caused a complete revolution in our views as to the causes of sterility, and it is therefore absolutely necessary to examine both husband and wife. Whether we begin with the one or the other is in the main immaterial; but as examination of the semen is much simpler, while in the case of a woman a diagnosis of sterility is much more difficult and sometimes requires general anesthesia, it is more logical to begin with the husband. At all events it should first of all be ascertained whether he is capable of begetting children, before the woman is subjected to a course of treatment.

Examination of the Husband. This must include an investigation as to his power of performing the sexual act and of impregnating the ovum (potentia coeundi et generandi). Since this chapter is devoted to sterility in the female, I shall not go into the causes of the former nor describe in detail the pathologic changes that have been found in the semen, which will be found in special textbooks on the subject by Zülzer, Oberländer and Fürbringer. A word of advice in

regard to the method of obtaining the semen may not be amiss, however. The specimen to be examined must have been ejaculated regularly during coitus. Semen obtained from an involuntary discharge that has dried on the clothing is absolutely valueless; compression of the seminal vesicles by introducing a finger into the rectum, a method frequently practiced by genito-urinary surgeons, does not always yield a sufficient quantity of semen; and the material obtained by masturbation may, in the case of an inexperienced individual, consist of nothing but prostatic fluid. The semen ejaculated during sexual congress should be received in a rubber condom, or withdrawal may be practiced and the semen discharged into a test-tube. The specimen must be examined under the microscope within an hour after coitus and kept at body-temperature during the interval.

Examination of the Wife. The search for a cause of sterility somewhere in the body is much more complicated in the case of a woman because it may reside in any portion of the genital organs, or in the organism as a whole and particularly in the nervous system, inasmuch as any disturbance of the genital functions may be due to nervous or general causes.

The sole function of the female genitalia is impregnation of the ovum, its subsequent nutrition, and expulsion of the fully developed product of conception. Each individual organ plays its special part in this function. Sterility occurs when any one of the organs becomes useless for the purposes of conception. Hence sterility is not an independent pathologic condition, but a symptom of various genital diseases. The physician must determine what organ is primarily responsible for the sterility and also the disease which is the direct cause. The diagnosis must therefore take account of all the organs concerned in conception, although, as their comparative importance is different and the diseases to which they are subject vary in frequency, they are not all of equal diagnostic significance.

As a foundation for the functional examination of the individual genital organs the physician must possess an accurate knowledge of the **mechanism of conception**, and I am therefore compelled to begin with its description so far as it applies to the woman.

Mechanism of Conception.

Conception presupposes a normal coitus, in which the semen containing viable spermatozoa is deposited in the upper portion of the vagina. If the os is open, the semen may be directly injected into the lower portion of the cervix; but this is by no means essential. The entrance of the spermatozoa into the external os, which usually dips into the seminal lake, is effected chiefly by the motility of the spermatozoa. The livelier they are, the more readily they effect an entrance. If they are retained too long in the vaginal vault, the functional power of the

spermatozoa is diminished because the acid of the vaginal secretion paralyzes and ultimately abolishes their motility. It has never been positively determined whether the semen is aspirated into the cervix after the mucous secretion of the canal has been expelled by the uterine contractions. As soon as the spermatozoa have entered the cervical canal they travel upward along the wall of the cervix, pass through the external os into the uterine cavity, and meet the ovum. The meeting point of semen and ovum has not been definitely determined, but most investigators agree that the meeting takes place in the tube and possibly in the abdominal extremity. If that is the case, the spermatozoa have a long distance to travel and must be possessed of active and prolonged motility; the life of the spermatozoa is probably from 6 to 8 days. A second prerequisite for conception is that an ovum capable of being impregnated shall arrive at the point where conception takes place. The ovum matures in the Graafian follicle of the ovary; just how an ovum must be constituted for purposes of conception, and whether there are ova which are naturally incapable of being impregnated, we do not know. The follicle grows by a gradual accumulation of fluid, reaches the surface of the ovary, and ruptures. This process takes place during the premenstrual congestion, probably a few days before menstruation. After the follicle has ruptured, the ovum with the follicular fluid is expelled into the abdominal cavity and must be taken up by the fimbriated extremity of the tube. The nearer the fimbriæ are to the ovary, the more readily they take up the ovum. It is very improbable that the abdominal extremity of the tube swells up and undergoes erection, or actually grasps the ovary during this process. From the position of the ovarian fimbria it is evident that the ovum can follow this path only in exceptional instances. In its short passage from the point where the follicle ruptures to the nearest border of the fimbriæ the ovum is very probably assisted by a current which is set up by the movement of the ciliated epithelium in the tubes, in a direction toward the lumen of the tube. As soon as the ovum has been taken up by the tube it is easily retained among the folds and carried onward toward the uterus by the ciliated epithelium, until it meets the spermatozoön. Contraction in the muscular wall of the tube for the purpose of carrying the ovum onward, if it occurs at all, is possible only in the uterine portion, where it may be necessary for the onward movement of the ovum after it has become impregnated. If the ovum fails to enter the tube it is destroyed in the abdominal cavity. The ovum begins to undergo the first changes, which result in its becoming embedded in the uterus by means of the villi of the ectoderm. This is the beginning of pregnancy. To what extent the nervous system and the psychic functions take part in conception is difficult to say, but it is very

probable that the normal voluptuous sensation experienced by the woman facilitates conception.

Conception accordingly presupposes the functional integrity of all the genital organs and the action of various mechanisms. Many different disturbances may therefore produce sterility, and the diagnosis of its causes requires a very thorough examination. The history is of secondary importance, although occasionally the statements of the patient may at once reveal the cause of the sterility (see later). In making an objective examination the function of each individual organ must be constantly kept in mind, and examination must determine whether the organ is capable of performing this function.

We begin with the **external genitalia**, whose function during conception consists solely in permiting the penis to enter the vagina. The causes of sterility in this respect may be adhesions of the vulva due to malformations or ulcerative processes; large neoplasms which prevent the approach of the penis, such as large lipomata, elephantiasis, or abnormally long labia minora and clitoris. The act may also be difficult if the vulva is situated abnormally far backward. Caruncles around the external urethral orifice may be so sensitive as to forbid the approach of the penis. Certain changes in the external genitalia (see p. 549) are of importance because they arouse the suspicion of hermaphroditism, which explains the apparent sterility. With regard to these abnormalities of the vulva, it is to be remembered that actual penetration of the penis into the vagina is not necessary for impregnation, as the spermatozoa may be sufficiently active to make their way into the vagina and uterus when they are deposited on the outside of the genitalia. Hence, if the vulva is not completely occluded, and the semen can be deposited in front of the introitus, there is a possibility of conception taking place. Catarrhal conditions at the vestibule interfere with coitus because they cause pain, and in craurosis vulvæ the contraction of the vestibule is sometimes so great that the penis cannot be introduced.

External Genitalia.

The causes of sterility that are operative at the **introitus** in the main affect the permeability of the passage and render conception difficult without, however, preventing it altogether. The hymen, which may resist attempts at cohabitation for some time, prevents the entrance of the penis unless it is very much distended, but does not render conception impossible because the spermatozoa are capable of passing through the hymeneal opening and reaching the uterus even if the penis is not introduced. There have been numerous cases of pregnancy with an intact hymen and when the opening in the membrane was extremely small. Atresia of the hymen is of course an absolute bar to coitus. A more serious obstacle to conception is pre-

Introitus Vaginæ.

sented by vaginism because the extreme sensitiveness at the introitus does not permit the approach of the glans, and the introitus is closed by spasmodic contractions of the constrictor cunni. In every day practice vaginism is quite a frequent obstacle to conception, although it does not render it absolutely impossible. The diagnosis is based on extreme sensitiveness at the introitus, the presence of hymeneal remains, and the occurrence of reflex spasms of the muscles around the introitus and in the floor of the pelvis following the slightest irritation of these areas. In certain aberrant cases of vaginism the parts are not in the least sensitive to the touch and the width of the introitus is normal; but whenever cohabitation is attempted, the constrictor cunni and levator ani muscles contract and prevent the introduction of the penis. The cause in these cases is psychic.

In a case of this kind, in which dilatation had been performed without benefit by another physician, I effected a cure by having the husband, who was a doctor, administer an injection of morphin immediately before cohabitation. This had the effect of preventing the muscular contractions, the act was performed in the normal manner, and in a short time pregnancy occurred.

Abnormal width of the introitus, which is present in cases of prolapse and old perineal tears, frequently interferes with conception because the seminal fluid escapes from the vagina immediately after the sexual act.

The function of the **vagina** is to receive the penis during the sexual act so that the semen may be deposited in front of the vaginal portion of the cervix, and to retain it there until the spermatozoa have entered the uterus. Hence total absence of the vagina, which is usually associated with severe developmental disturbances of the uterus, is obviously a cause of sterility. In such cases coitus usually takes place through the urethra or rectum, and pregnancies have been observed in cases in which the lower portion of the vagina was completely occluded and there existed a rectovaginal or vesicovaginal communication. In cases of double vagina sterility is observed when the sexual act has been performed in the half which is occluded. In order to perform its function the vagina must be patulous as far as the vaginal portion; hence cicatricial stenosis of the vaginal wall, like the so-called circular stenoses, interferes with conception, but, as in the case of intact hymen, does not necessarily prevent it altogether. Occlusion of course is an absolute bar to conception. Large, projecting cysts of the vaginal wall also interfere with the introduction of the penis. Adhesive fleshy bands running from the vaginal portion to the vaginal wall prevent the entrance of the seminal fluid. Stenosis of the vagina followed by sterility may also be due to tumors of the wall, such as carcinoma and sarcoma, or tumors pressing on the lumen of the vagina from without, particularly when they are situated in

Vagina.

Douglas' space. Downward displacement of the vagina and prolapse do not always cause sterility because they are replaced during the act of cohabitation. The vagina must also be wide enough to receive the penis, and of the necessary length, else the glans will enter one of the vaginal vaults and deposit the semen there. As a rule, however, differences of this kind in the dimensions of the genitalia are equalized during normal cohabitation. An abnormally short vagina is an obstacle to conception because the spermatic fluid is apt to escape, while an abnormally wide and relaxed vagina has the same disadvantage, especially if the introitus is very wide and there are old perineal lacerations, or reflex contraction of the constrictor cunni and levator ani muscles, the object of which is to retain the semen, fails to take place. Escape of the semen is a frequent cause of sterility and usually points to abnormalities of the vagina. Vaginal catarrh sometimes prevents conception because the spermatozoa are washed out of the canal with the secretions and because the hyperacidity of the vaginal secretion weakens the vitality of the spermatozoa. Patients with vesicovaginal fistulæ are usually sterile, partly because the acid urine kills the spermatozoa and washes them away, and partly because these patients usually suffer from amenorrhea.

Vaginal Portion.

The **vaginal portion** probably has no other function during conception than to dip into the seminal lake in the vaginal vault and thereby facilitate the entrance of the spermatozoa into the uterus. Nevertheless any abnormality in its position relative to the axis of the vagina, its shape and the width of the external os, may interfere with conception. The most favorable position is that in which the vaginal portion forms a right angle with the vagina and lies exactly in the median line, with the os directed accurately backward and downward (in other words the normal position of the cervix), because in that position the penis, entering from in front and above, deposits the semen immediately in front of the external os. Any deviation from this position interferes more or less with conception but does not render it impossible. Changes in the shape of the vaginal portion not infrequently cause sterility. Elongation of the portio, such as infravaginal or penis-shaped hypertrophy, elongation of one lip in the form of an apron with displacement of the os to the opposite side, follicular hypertrophy, or a long conical vaginal portion may interfere with conception in the absence of any other complication, because the penis glides by the vaginal portion and deposits the seminal fluid in the vaginal vault. Shortening and absence of the vaginal portion are often found in sterile women. They are, however, not in themselves the cause of sterility, but indicate a coexisting atrophy of the uterus. Stenosis of the external os is an important condition. Before the technique of

bimanual examination was developed and diseases of the tubes and peritoneum were not recognized, these stenoses were usually regarded as the cause of sterility. Occlusion of the external os is of course an absolute bar to conception; but simple stenosis plays a variable part in the causation of sterility in different cases. The spermatozoa do not need much room, and pregnancy is therefore occasionally observed when the os is so narrow that only the smallest sound can be introduced. It should also be mentioned that congenital stenosis of the external os, with a long, conical cervix, is associated with atrophy of the uterus; the cervical canal behind the contracted os is frequently the seat of catarrh, and the inspissated secretion prevents the entrance of the spermatozoa. Hence these disturbances, which are much more important causes of sterility, must be excluded before the condition can be attributed to stenosis of the external os alone. Sometimes this requires a dilatation. In the main it is advisable not to lay too much stress on this form of stenosis; at least it should never prevent a careful examination of the higher portions of the genitalia. With regard to congenital stenosis of the external os resulting from plastic operations or ulcerative processes, their significance must not be overestimated as they are not an absolute bar to conception. The same is true of stenosis due to carcinoma or myoma. The diagnosis of stenosis presents no difficulties. The os is exposed in a Simon speculum and the patulence of the canal determined by introducing a sound.

In order to play its important part in conception the **cervix** must be patulous and permit the entrance of a viable semen into the uterine cavity. Hence disturbances referable to the cervix are always of a purely mechanical nature. It is needless to say that complete occlusion is an absolute bar to conception. The diagnosis is made with the sound and sometimes by the presence of hematometra, which is regularly present in sexually mature women. Without hematometra complete occlusion is very improbable. It is much more difficult to decide what part stenosis of the cervix plays in the production of sterility. In the first place, it is not easy to diagnose a stenosis, because the sound is very apt to catch in the recesses and folds of the normal cervix and because, as has been mentioned in connection with dysmenorrhea, the lumen may be obstructed by folds of mucous membrane which yield to the passage of the sound, so that the stenosis is overlooked. Various malpositions of the uterus, such as anteflexion and retroflexion, produce apparent stenosis by kinking of the cervical canal. True stenosis may be said to exist when a sound about 2 mm. in thickness cannot be made to pass a certain point even when the vaginal portion is drawn down with a tenaculum. The site of predilection is the external os; but stenoses also occur in the course

Cervix.

of the canal, particularly as a result of malignant processes. As in the case of the external os, stenosis of the cervix is not an absolute bar to conception, but merely renders the act more difficult. In many cases it is not the only cause of sterility, which is due rather to the same cause as the stenosis itself, namely catarrhal diseases of the mucous membrane, and to its results, especially the accumulation of secretions in the cervical canal. While too much importance has no doubt been attached to stenosis of the cervix as a cause of sterility, it cannot be denied altogether, as cases in which pregnancy follows a single dilatation are not very infrequent. If a stenosis is definitely recognized it should be regarded as the cause of the sterility and subjected to treatment. Tumors of the cervix also act chiefly as mechanical obstacles; myoma causes displacements and contractions of the cavity, mucous polyps may obstruct it altogether. Carcinoma causes contraction of the canal in the early stage and later may produce dilatation, while the decomposing secretions kill the spermatozoa or flush them out of the canal. Elongation of the cervix accompanying prolapse is another cause. Severe cervical catarrh is not infrequently associated with sterility, partly because the inspissated secretions obstruct the cervical canal, especially when they accumulate behind the external os in nulliparous women; and partly because they wash the spermatozoa away, especially in cases of purulent catarrh, in which the chemical composition of the secretion is changed.

In the **body of the uterus**, which performs several functions during the act of conception, a variety of functional disturbances may cause sterility. In the first place the uterine body affords the spermatozoa access to the ovum within the tube and retains the impregnated ovum. The integrity of the spermatozoa must be maintained until impregnation takes place. The chief function of the uterus, however, is to permit the impregnated ovum to become embedded within its cavity.

Body of the Uterus.

The first requisite, therefore, is the presence of a uterus capable of performing its function; any marked malformations, such as a rudimentary uterus without a cavity, or a fetal uterus with elongated cervix and short body, cause sterility. An infantile uterus and marked degrees of hypoplasia are also, as a rule, accompanied by sterility; but it is difficult to decide whether the uterus itself or the atrophy of the ovaries, which is also present, is the chief cause. Menstruation may help to clear up the question. If it is absent or the flow is abnormally feeble, sterility is almost regularly present also. Acquired atrophy, whether due to disease of the uterus or to general conditions, is somewhat uncertain in its relation to sterility; as a rule the character of the menstruation will reveal the cause of the sterility. If menstruation

is absent, these atrophies usually lead to sterility; although many exceptions are observed, *e.g.*, conception during the amenorrhea of lactation and during convalescence from severe diseases. Concentric atrophy is a much more certain cause of sterility than eccentric. Double malformations of the uterus do not, as a rule, lead to sterility, provided the function is completely preserved in one half. Total or partial atresia or stenosis of the uterine cavity, which may follow severe puerperal disease, cauterization or curettage, constitute purely mechanical obstacles. The diagnosis is based on the finding of a stenosis with the sound and the presence of hematometra whenever the mucous membrane is capable of functionating. With regard to displacements of the uterus as a cause of sterility, cases complicated by catarrh of the uterine mucous membrane, chronic pelvic peritonitis and diseases of the adnexa must be excluded. There are two ways in which a malposition may prevent or interfere with conception: abnormal position of the vaginal portion in the vagina, and angulation at the internal os due to flexion. Marked degrees of lateroversion and lateroposition very often cause sterility because the penis deposits the semen in the vaginal vault, which is in the median line and not in front of the more laterally situated external os. In the same manner in marked degrees of retroflexion access to the external os may be difficult because it is placed far forward. In retroversion and in anteflexion the vaginal portion is more favorably situated for the reception of the spermatozoa. Prolapse is not so apt to form an obstacle because it is often corrected during the sexual act. Flexion with contraction of the internal os may or may not be the cause of the existing sterility. In multiparæ it is hardly worth mentioning, although retroflexion in multiparæ may interfere somewhat with conception. With nulliparous women the case is different. Sterility often accompanies anteflexion, but the anteflexion is not always the cause of the condition. If we omit cases in which the anteflexion is secondary to posterior parametritis, or merely represents a minor feature of insufficient development of the uterus, and consider only those in which the anteflexion is congenital and uncomplicated, displacements are very unimportant as a cause of sterility and at most interfere with conception by causing angulation at the internal os. The same applies to uncomplicated retroflexion in nulliparous women in whom the already existing contraction of the canal becomes accentuated. In complicated cases the etiologic significance of displacements can only be determined by observation or by noting the results of treatment, particularly dilatation of the cervix.

The only neoplasms of any significance as causes of sterility are the myomata, which operate by obstructing and narrowing the

uterine cavity and thereby preventing the semen from reaching the ovum, or through the profuse secretion of the uterine mucous membrane and endometritis which they also produce. As these conditions are always present in cases of submucous myoma, that variety of tumor is the most common cause of sterility. These generally accepted views have been shaken and in part refuted by Hofmeier, who has shown that in many cases myomata probably facilitate instead of preventing conception. Carcinoma is rarely a cause of sterility because it usually occurs in senile women or in women whose fertility is on the wane. Like sarcoma it undoubtedly interferes with conception.

From a practical standpoint the most important cause of sterility in the uterine cavity is endometritis, because the abnormal secretions which it produces prevent the entrance of the spermatozoa and flush the ovum out of the cavity, because the smooth, atrophic membrane is unable to retain the ovum, and finally because of the difficulty or impossibility of the endometrium's being converted into a decidua. If in addition it is remembered that endometritis is an important cause of habitual abortion, it is evident that this disease is by far the most frequent cause of childless marriages. The various forms of endometritis are not of equal etiologic importance. Conception is sometimes observed in the presence of chronic hyperplastic inflammation associated with severe hemorrhage, more rarely in catarrhal, and most rarely in dysmenorrheal and exfoliative endometritis. The sterility which so often accompanies chronic metritis is usually due to a complicating endometritis.

The question whether the **tubes** are responsible for the sterility is comparatively simple because the part which they play in conception is also a simple one. It consists in the reception of the ovum; its expedition, whether impregnated or not, into the uterine cavity; and its maintenance during that time in a viable condition so that it may become impregnated or develop into a fetus. The reception of the ovum presupposes patulence of the fimbriated extremity. Diseases which produce closure of the tubes are an absolute bar to conception. Occlusion is diagnosed by its sequelæ or so-called retention tumors—pyosalpinx, hydrosalpinx and hematosalpinx; occlusion probably exists also in severe salpingitis of any kind, particularly when there are adhesions in the neighborhood of the abdominal extremity of the tube. The orifice of the tube must furthermore be situated near the ovary. It is not possible to determine the position of the normal infundibulum; but if there is local pelvic peritonitis in its neighborhood, the structure is very probably fixed. After the ovum has entered the tube it is retained by the folds of mucous membrane and swept along by the movement of the cilia, provided the mucous membrane is normal. For this reason endosalpinx in itself is an obstacle to con-

Tubes.

ception and, in addition, when the infundibulum is open, the ovum may be washed out by the secretions, or the organisms which they contain may destroy the ovum. If the infiltration involves the wall of the tube, the latter becomes rigid and no longer capable of muscular contraction for the purpose of pushing the ovum onward. Hence salpingitis interferes with conception in a variety of ways and in its various stages no doubt represents the most frequent cause of sterility. Whenever distinct thickening of the tube is present it may usually be regarded as the cause of the sterility, although it must be admitted that mild degrees of inflammation may subside without abolishing the function of the tube.

The function of the **ovary** in the act of conception consists in maturation of the ovum and its discharge into the tube. The details as well as the disturbances of the process of ovulation are entirely beyond our ken. Clinically they are manifested in atrophy of the ovaries and may be recognized by two signs—diminution in the size of the ovaries and cessation of menstruation. So long as menstruation continues it is very probable that mature ova are being produced. If it ceases, however, and the ovaries are small, ovulation must be regarded as abolished or at least impaired; hence the association of these two signs is directly in favor of ovarian sterility. The physiologic type of the latter is found in the menopause. The pathologic causes of deficient ovulation are congenital hypoplasia of the ovaries; atrophy due to diseases and other conditions (see Amenorrhea, p. 618); acute and chronic oöphoritis, which also interferes with ovulation, with maturation of the ovum, with the formation of follicles, and renders conception improbable. The extrusion of the ovum from the ovary necessitates a slight rupture of the follicle; hence thickening of the ovarian stroma as in chronic oöphoritis, the deposition of peritonitic exudate, the formation of peritoneal adhesions, and the formation of peritoneal cysts on the ovary which is included in the term perioöphoritis, interfere with conception and may produce complete sterility. As regards ovarian tumors, it may be stated in general that so long as any ovarian tissue capable of functionating remains, conception is still possible; hence a unilateral tumor does not directly affect conception, although it may be an indirect cause by displacing the uterus, vagina and adnexa. Even in the case of bilateral ovarian tumors conception is possible so long as functionating ovarian tissue is present, which again may be determined by the behavior of menstruation. Sterility is observed most frequently with bilateral, malignant ovarian tumors.

Ovary.

The last organs which must be included in the examination are the pelvic peritoneum and the connective tissue.

Pelvic peritonitis plays a very prominent part in the etiology of sterility. Aside from cases in which the pain is so severe as to prevent normal coitus and cases in which conception is out of the question on account of the presence of large exudates which displace the uterus and completely surround the organs, especially the tubes—cases in which the sterility rarely comes up for diagnosis—chronic pelvic peritonitis with adhesions for a variety of reasons is the most common cause of sterility. The uterus itself may retain its function even when it is completely surrounded and fixed by adhesions. Adhesions are therefore less important than perisalpingitic and perioöphoritic processes. Adhesions may completely surround the tube and cause contraction or angulation of the canal; or the infundibulum, which is the most common starting point of pelvic peritonitis due to tubal disease, may become fixed at some distance from the ovary; or the lumen may be occluded by adhesions. Not infrequently the portion of the peritoneum between the tube and the ovary, along which the ovum travels during its passage to the tube, becomes rough as a result of inflammation, or covered with adhesions. On the other hand, peritonitis may produce the above-described changes in the ovary; in short, chronic pelvic peritonitis interferes more with the process of conception and more often destroys the function permanently than any other disease. In many of these cases the complicating tubal diseases alone interfere with conception.

Pelvic Peritoneum.

Parametritic processes play a minor part in the etiology of sterility because they are extraperitoneal and do not impair the functions of the organs. Sterility is observed, however, in cases of large parametritic exudates on account of the marked displacement of the organs and the interference with the nutrition of the entire body; the same is also true of extensive parametritis with atrophy. The circumscribed retracting (posterior) forms occasionally produce sterility by displacing the uterus and ovaries.

Parametrium.

In the manner just described we must look for some organic change capable of disturbing the process of conception. As many of these causes consist in minute changes of the peritoneum and of the tube which can be felt only under especially favorable circumstances, it is advisable always to examine under anesthesia unless very conspicuous changes point to the correct diagnosis. If after a careful examination under anesthesia no change in the organs of generation capable of producing sterility is found, we must turn our attention to two other possible factors—the general condition and the presence of disturbances in the nervous functions which are necessary for conception to take place.

Thus **nutritional disturbances** affecting the entire organism may produce sterility by causing atrophy of the uterus or interfering with

maturation of the ovum; whether both of these conditions develop at the same time or one is secondary to the other cannot be determined in every instance. As the ovarian function is in the great majority of cases chiefly affected by conditions causing emaciation or other change in the body, the causes of this class usually lead to both amenorrhea and sterility. Hence the general causes of amenorrhea detailed on page 618 must be taken into consideration with respect to sterility also; they need not be repeated in this place. We knew from experience, however, that amenorrhea and sterility do not always go hand in hand and that conception during amenorrhea is not such a very rare occurrence. The ovarian function may not be entirely abolished; it may be only that the ovarian stimulus is not sufficient to produce a menstrual congestion, or the uterine atrophy is so great as to render menstrual bleeding impossible. Conception during amenorrhea is observed frequently in cases of atrophy due to lactation, in the amenorrhea accompanying convalescence from severe diseases, and in obesity. Aside from these exceptions, however, amenorrhea is an important diagnostic and prognostic factor.

In addition there are a number of etiologic factors which, without appreciably impairing the function of the genital organs, *i.e.*, without producing amenorrhea, nevertheless interfere with the process of conception in some imperfectly understood manner, such as the nutrition, mode of life, temperament, mood, hard work, worry, consanguinity, and indifference between husband and wife. Whether these factors influence the ovarian function directly or disturb some other entirely unknown mechanism concerned in the process of conception, is as yet entirely beyond our ability to determine. Every clinician of experience will remember cases in which, even after careful examination of the woman and due consideration of all conceivable etiologic factors, the cause of the sterility still remains hidden and cannot be removed.

If no cause is found in the general condition, it remains to determine whether any nervous disturbances are present to interfere with conception.

The only process which is directly influenced by **disturbances of the nervous apparatus** is coitus, the disturbance consisting in some interference with the entrance of the semen into the uterus. Our knowledge in regard to this phase of impregnation is still very incomplete. It is probable that sensory irritation of the vulva, clitoris, and introitus sets up reflex processes in the vagina which manifest themselves in certain phenomena such as the discharge of the secretion from Bartholin's glands and contraction of the constrictor cunni and levator ani muscles, presumably for the purpose of retaining the semen in the vagina. The general indication that the

Dyspareunia.

function of this reflex apparatus, and especially the last step in the process, has been normally performed, is found in the feeling of pleasure and terminal satisfaction; hence this is in a measure a criterion whether this phase in the process of impregnation is normal. Clinical experience shows that conception undoubtedly occurs more frequently after coitus attended by great sexual excitement and a sense of complete satisfaction; but that, on the other hand, the sexual act may be followed by conception even in the absence of pleasure and satisfaction. Dyspareunia cannot, therefore, be regarded as an obstacle to conception, but it is a frequent complaint of sterile women and is undoubtedly in many instances related to sterility. The exact nature of the unfavorable influence in the individual case is, however, difficult to determine; it may be due to the following causes:

1. Diseases of the genital organs that prevent the feeling of pleasure by causing pain during coitus, such as vaginism, posterior parametritis, perimetritis, and tubal diseases.

2. Inadequate sensory irritation of the genitalia on account of excessive width of the introitus, impotence on the part of the man, awkwardness in performing the act, infantile genital organs.

3. General somatic and nervous conditions that interfere with the reflex sensation of pleasure, such as general debility, certain forms of neurasthenia and hysteria.

4. Hysterical states that prevent sexual excitement, such as aversion for the man, contrary (perverted) sexual sensations, masturbation.

The causes of dyspareunia sometimes coincide with those of sterility.

The **history** is not altogether without importance in the diagnosis of the cause of sterility. In the first place the question whether the case is one of true sterility or habitual early abortion is determined by the duration of the marriage. The history may indicate whether the husband or the wife is at fault, as when one or the other has had children by a former marriage, or has had some disease such as gonorrhea which frequently causes sterility. It is important to determine whether the sterility is primary or secondary, because the etiology is different in the two conditions. Thus, in cases of secondary sterility congenital causes such as anteflexion and stenosis may be excluded at once, and the sterility is found to be due usually to acquired, and in most instances inflammatory causes. Above all the physician should never neglect to inquire, especially in the case of young, inexperienced husbands, in what manner the act is performed; it is almost incredible how often the cause of a sterility is found in awkwardness or in some absolutely erroneous notion on the part of the husband.

Anamnesis

Analytical Diagnosis of Abdominal Tumors.

In the section devoted to special diagnosis the diagnostic features of every variety of abdominal tumor, so far as they can be determined by clinical examination, have been fully given. Nevertheless, under the impression that the practitioner needs some special guidance in the differential diagnosis of difficult cases, I shall summarize abdominal tumors from the standpoint of analytical diagnosis. In ordinary cases the diagnosis of an abdominal tumor is made about as follows. The physician finds a tumor in the abdomen and makes a provisional diagnosis based on some prominent feature of the growth. Thus, if it is large and cystic, it will be taken for an ovarian tumor; if it is round and hard, for a myoma; if an extensive area of resistance is felt in the pelvis, it will be regarded as an exudate. The diagnosis is then confirmed or revised by seeking for further signs. But in the more difficult cases, in which the diagnosis is not at once suggested by some conspicuous sign, the physician usually vacillates between various theories and is very apt to dismiss the patient with a diagnosis of 'abdominal tumor.' For cases of this type I shall point out an analytical method by which a correct diagnosis can be made. Needless to say, I shall have to be brief and refer the reader for further studies to works on special diagnosis. Nevertheless a certain amount of repetition will be unavoidable.

Beginning with **large abdominal tumors situated above the pelvic inlet**, there are certain features of diagnostic importance which are determined by external examination. The most conspicuous characteristic of the tumor is its size, which, however, is of very little diagnostic value because size is not characteristic of any one kind of tumor. Nevertheless certain genital tumors, such as encapsulated hematomata, exudates and tubal tumors, rarely attain such a size as to project far above the pelvic inlet; while, on the other hand, ovarian tumors, uterine myomata, in rare cases pelvic connective tissue fibromata, hydronephrosis, echinococcus cysts of the abdominal glands, and especially ascites, which from a diagnostic standpoint must be included among abdominal tumors, may attain an unusual size.

The shape of the tumor, which is next determined, has a considerably greater diagnostic value. It is important to determine whether the tumor is round, or flat and diffuse; and, if the growth consists of several segments, whether each part is round or whether some of them merge with the adjoining structures without any definite boundary line. In a general way it may be said that all new-formations and retention-

tumors are round or oval; this is true of ovarian tumors, myomata, parovarian neoplasms, large tubal tumors, neoplasms and retention-cysts of the kidneys, retroperitoneal tumors, etc. An exception is found in malignant neoplasms which are not confined to the affected organ and spread into the adjoining structures. The main tumor, which can usually be outlined fairly well, is generally surrounded by numerous indistinct accessory tumors. All inflammatory tumors, whether peritoneal or parametrial, are characterized by flatness and a distinct outline. On the other hand, the shape of a hematoma may be quite irregular, as the blood may have forced its way between the organs before the occurrence of coagulation. In determining the shape of the tumor the surface must also be examined. Myomata of the subserous type have a perfectly smooth surface as if they had been turned out with a lathe. Some ovarian tumors also have a smooth surface; while in others the surface is irregular from the presence of shallow retractions, lobulations and prominences, especially in the case of malignant tumors, or on account of the papillæ that have broken through the surface. Irregularities may also be due to adherent coils of intestines or, as in the case of renal tumors, to loops of intestines on the anterior surface of the tumor. Tortuosities usually indicate a tubal tumor.

Next the consistency of the tumor is to be investigated, particularly whether it is cystic or solid. Solid tumors may be hard or soft, and a cyst may be tense, or only partially full and flaccid. The consistency of a tumor is, however, the pivotal point of the differential diagnosis in the case of the genital organs, because of the two different representatives—ovarian tumor and myoma—one is cystic and the other usually solid. It is quite difficult to make out the consistency of a tumor, and most mistakes in diagnosis are unquestionably due to failure to interpret this feature correctly. The abdominal walls form the chief obstacle, and the degree of pressure used must be regulated by the resistance encountered. If it can be positively determined that the tumor is solid and that it originates in the genital organs, it is in a great majority of the cases a myoma. Solid ovarian tumors are rare, and multilocular cysts with small cavities are only hard in places. In tumors of other organs a hard and solid consistency indicates carcinoma, while a hypertrophied liver or spleen also feels solid, but the consistency is more elastic than hard; it is in fact a peculiar parenchymatous consistency. A cystic tumor, provided ascites and a fluid exudate can be excluded, is most likely an ovarian cyst, more rarely a parovarian cyst, or a large tubal sac. Uterine tumors are rarely cystic—so-called cystic myomata. Among cystic tumors originating in other organs we have retention-tumors of the kidneys, echinococcus-cysts, mesenteric and retroperitoneal cysts and pancreatic cysts.

The most important step in the diagnosis consists in determining the position of the tumor because in a large number of cases the tumors retain the position of the organs from which they originate. This is true of tumors of the liver, spleen and kidneys, except that the latter may be prolapsed from relaxation of their peritoneal attachments. The position of pancreatic cysts, omental tumors and retroperitoneal tumors is also characteristic. These tumors differ from genital tumors by the fact that the latter are situated lower down and cannot be differentiated by their position; for tumors of the uterus, as well as of the ovaries and parovaria, constantly tend to occupy a median position so long as they retain any degree of mobility. The impression which prevails among inexperienced physicians that uterine tumors must be situated in the median line and ovarian tumors to one side of the median line is erroneous; it is only when they have lost their mobility in an early stage of their development that a lateral situation is observed, as in the case of large tubal tumors.

The mobility of a tumor may often assist in making the diagnosis, as the mobility of tumors of the liver during respiration, the immobility of extraperitoneal tumors of the kidneys, and the immobility of tumors originating from the retroperitoneal organs in general. Genital tumors as a rule have a certain degree of mobility unless they are intraligamentary or incarcerated. Mobility in the case of genital tumors is of less value in the differential diagnosis than as an indication of the seat of the tumor.

In many cases the above characteristics of abdominal tumor, if they can be accurately determined, suffice for the diagnosis. But as a rule the diagnosis is not absolutely positive until it has also been ascertained from what organ the tumor takes its origin. For our present purpose the main point to determine is whether the tumor originates in the genital organs or not. Genital tumors are characterized by the fact that they grow out of the true pelvis and lie upon the pelvic inlet or project above it, depending on their size, one segment usually remaining within the pelvis. Hence the outer contour of the tumor can be made out as beginning at the pelvic inlet and extending in all directions. On the other hand, tumors that do not originate in the genitalia can be distinctly delineated above the pelvic inlet, although they cannot be differentiated from the organ to which they belong; hence a zone of intestines can usually be made out by percussion and palpation between the lower boundary of the tumor and the pelvic inlet. While this is the rule, there are many exceptions. If they are very large the tumors may be in such intimate contact with their organs as to give the impression that they originate in those organs; or in exceptional cases, *e.g.*, when the pelvic inlet is greatly contracted or the tumors are adherent

to organs in the upper part of the abdomen and to the abdominal wall, they may be so high that their lower boundary can be plainly made out. Again, tumors of the liver, kidneys and spleen and large paratyphlitic exudates may grow downward and disappear in the pelvis. Hence the origin of the tumor cannot always be determined by following its outlines. In these cases the mode of fixation, which may be characteristic, is of value. Genital tumors are fixed below, *i.e.*, when the tumor is lifted out of the pelvic inlet with both hands a certain resistance is felt, and as soon as the tumor is released it returns to the pelvic inlet. Tumors originating in the liver, spleen and other organs, on the other hand, are fixed in a corresponding direction, and when they are displaced by traction they return to their original site and permit their connection with the organ to be palpated directly. In the case of movable kidney and spleen this sign is, however, entirely absent, as these tumors are equally movable in all directions and the only indication of their origin is found in the fact that they can be replaced into the site of the corresponding kidney or spleen. The best method of differentiating between genital tumors is bimanual examination. If the tumor is not a genital tumor, it is possible to palpate the genitalia in their normal position, *i.e.*, the uterus and both ovaries have no connection whatever with the tumor. Unfortunately genital tumors cannot always be excluded in this way because it is not always possible to demonstrate both ovaries.

After the genital nature of the tumor has been recognized in this way the particular organ from which the tumor takes its origin remains to be determined. Large tumors extending far above the pelvic inlet are usually derived from the uterus and ovaries. The examiner should always turn his attention first to the uterus. The best way of making sure that a large tumor is uterine is to determine its connection with the vaginal portion. In uniform enlargement of the uterus, as in pregnancy and interstitial myoma, it is easy to feel the vaginal portion gradually broadening out and merging with the lower portion of the tumor; in the case of large mural tumors it is somewhat more difficult, as in such cases the vaginal portion merges with the peripheral portion of the tumor, and it may be difficult to determine whether the uterus is merely in contact with the tumor or forms part of it. If a pedunculated connection is felt between the tumor and the uterus, the nature of this connection alone must determine whether the tumor is uterine or not. It has often been given as a diagnostic sign that, when a uterine tumor is displaced by manipulation through the abdominal walls, the vaginal portion moves with it, and that the latter remains immovable when a large ovarian tumor is displaced in the same way. While this is true in the case of uniform enlargements of the uterus and ovarian

tumors with slender pedicles, the sign is a fruitful source of error in the case of most tumors. For, to begin with, pedunculated subserous myomata have a distinct and independent mobility of their own which does not at all affect the uterus; while, on the other hand, intraligamentary tumors or such as have a broad attachment to some part of the uterus often cannot be moved independently of the organ and therefore cause the vaginal portion to move with them. The merging of the vaginal portion with the tumor is also difficult to recognize during pregnancy owing to the marked softening of the lower uterine segment, and in the presence of moderate degrees of flexion at the internal os. Although the above-mentioned sign must be regarded as the most positive and although it can be elicited with least discomfort to the patient, nevertheless it has its limitations, and if it fails, resort must be had to sounding. A tumor is identified as a uterine tumor by finding the uterine cavity in its interior or along the margin. The direction taken by the sound as it is introduced into the tumor may suffice to establish this point. If not, the instrument is carefully carried as far as the fundus until the tip is felt in some portion of the upper or lateral periphery. Of course similar findings may be obtained if the uterus is partly attached to the intraligamentary tumor. Doubtful cases may be cleared up by measuring the cavity. In rare cases an intraligamentary tumor, not originating in the uterus, may distend the organ to such a degree that the cavity is appreciably increased in length; nevertheless elongation of the uterine cavity is one of the most reliable indications that the tumor is of uterine origin. Compared with these two signs, a third, namely the course of the round ligament, has but a limited value. If the ligaments can be plainly traced on the surface of the tumor, the tumor is uterine; for the round ligaments do not come in relation with the para-uterine tumors unless they have been displaced somewhat forward and upward by a broad intraligamentary development so that they follow an oblique course over the anterior surface of the tumor.

If the uterine origin has been established in this manner, and the tumor is large and projects above the pelvic inlet, the diagnosis can only be myoma, pregnancy, or possibly a large sarcoma. For the differential diagnosis of these conditions see page 297.

If it is certain that the tumor does not originate in the uterus, it must be a para-uterine tumor in the wide sense of the term. The only conditions which we have to consider are tumors of the ovary and parovarium (rarely of the tubes), large extravasations of blood, occasionally large intraperitoneal exudates, and advanced extraperitoneal pregnancy. The first thing to be determined is the outline of the tumor. If the latter is everywhere distinct and the tumor has a wall of its own, hematomata and exudates may be excluded and the tumor must be

ovarian, parovarian or tubal. Even in the presence of complicating inflammatory processes in the neighborhood the wall of the tumor can usually be felt quite distinctly. With regard to consistency, the above-named tumors are usually distinctly cystic; but exudates, particularly of peritoneal origin, may also yield fluctuation, and occasionally a hematocele may remain completely cystic and simulate the consistency of an ovarian tumor. A distinctly outlined, cystic tumor is, judging by frequency, in all probability an ovarian tumor. But the differential diagnosis must be confirmed by demonstrating that the tumor is connected with the uterus by a cord or, in rare cases, by the broad ligament (intraligamentary tumor); for the diagnosis of parovarian tumors it is necessary that the ovary be felt with the pedicle on the same side; while tubal tumors are characterized chiefly by the thickening of the uterine portion of the tube and the fact that they are usually bilateral. If the outlines are diffuse and the growth is connected with neighboring structures, it suggests an inflammatory process or an extravasation of blood, and the further distinction between these two processes is made by the degree of inflammatory reaction, the consistency, and certain data obtained from the history (see p. 488).

I have so far discussed only the large abdominal tumors which project above the pelvic inlet because these tumors, from the standpoint of differential diagnosis, bear a peculiar relation to tumors of the other abdominal organs. But the most important so-called gynecological tumors are the **small neoplasms which are contained almost entirely within the true pelvis.** The differential diagnosis of these tumors is much more important to the physician because they are more frequent, because the differences are less marked than in the case of the above-mentioned large tumors, and finally because tumors of various adjoining organs must also be taken into consideration. This group includes tumors of the uterus, ovaries, parovaria and tubes; hematomata and exudates of the broad ligament and of the parametrium; hematoceles and exudates of the peritoneal space; tumors of the bladder and rectum; tumors of the periosteum, of the pelvic bones and of the pelvic glands. The differential diagnosis of these tumors, which we group under the general term **pelvic tumors,** is exceedingly difficult and presents problems which even the expert specialist is sometimes unable to solve. Objective examination by bilateral palpation, here as elsewhere, forms the basis for the diagnosis. We first try to ascertain from what organ the tumor takes its origin. If this can be determined, the next question in regard to the character of the tumor is much easier to answer.

The examination is begun by looking for the uterus, partly in order to determine whether the organ itself is the seat of the tumor, and

partly, in case it is not, to obtain an important landmark by which to locate the tumor; for its position with reference to the uterus, whether it is ante-uterine, retro-uterine or para-uterine, or, in the case of several tumors, whether they are all on the same side of the uterus or bilateral—all these are important diagnostic points. The vaginal portion should be traced up into the tumor until the uterus is discovered. If the enlargement is uniform, as in the case of interstitial myomata, the organ may be found at once; not so, however, when the enlargement is irregular, because in that case the vaginal portion is joined to some portion of the periphery of the tumor and it is difficult to decide whether the tumor originates in the uterus or is merely para-uterine. This point must be decided by the width and character of the connection. When a tumor is merely in apposition with the uterus, a furrow can usually be recognized running the entire width of the connection between the tumor and uterus; while uterine tumors have a large or small pedicle growing directly out of the uterine substance. Doubtful cases must be cleared up with the sound, which almost always shows the cavity enlarged in uterine tumors. The adnexa and round ligaments cannot usually be palpated with any degree of certainty. If the uterus cannot be recognized by following the vaginal portion; if the organ is surrounded by several tumors of similar shape, such as subserous myomata; or if the contour of the organ is completely obscured by surrounding tumors of the adnexa, it may sometimes be identified by its consistency, which is softer than that of the surrounding tissue in the case of myomata, and harder than soft and cystic adnexal tumors. Sometimes the uterus may be discovered by palpating the entire periphery of the tumor with a succession of short taps and noting at what point the movement is transmitted best to the vaginal portion. In all doubtful cases the sound should be employed, unless the tumors forbid its use—tubal tumors, exudates, hematocele, intra-uterine and extra-uterine pregnancy. The direction of the sound shows where the body of the uterus is to be found, or it may be located by palpating the head of the sound through the abdomen with the external hand.

After it has been ascertained that the tumor belongs to the uterus alone, we must decide whether it represents a uniform enlargement of the uterus or is connected with it by a pedicle. Tumors of the latter class are always found to be either subserous myomata or sarcomata. If the tumor represents a uniform enlargement of the uterus, its consistency is compared with the normal consistency of the organ. Enlargements that are softer than the normal uterus indicate pregnancy, abortion or puerperal softening; while increased hardness points to chronic metritis, myoma or carcinoma. For the further differentiation of these conditions see p. 280.

If the tumor does not originate in the uterus, the diagnosis must be based on certain inherent qualities of the growth itself. If it is cystic, as determined by the presence of fluctuation, it is either an ovarian tumor, a tubal retention-cyst—especially hydrosalpinx—a parovarian tumor, or a recent pelvic exudate or hematocele. These tumors may occupy any position around the uterus, but they have certain seats of predilection which may also be utilized in the differential diagnosis. Exudates and hematomata are most apt to collect in Douglas' space, while small tubal and ovarian tumors usually remain near the mother organ; but since adnexal tumors may also occupy Douglas' space, the difference between fluid hematoceles and exudates on the one hand and ovarian tumors on the other, which are detailed on p. 477, must also be taken into consideration. A laterally situated cystic tumor probably originates in the tube and ovary, as a peritoneal, distinctly cystic tumor rarely occupies a lateral position. The differences between tubal and ovarian tumors have been discussed on p. 462. Solid tumors represent a much larger contingent, especially if we include small ovarian cysts and particularly the thick-walled dermoid growths, which are frequently mistaken for solid tumors. If the growth is solid, recent peritoneal exudates and hematocele are at once excluded, although a coagulated hematocele and an exudate during the stage of absorption may feel not only solid but often distinctly hard.

After it has been found that the consistency is hard, the shape of the tumor is investigated in the hope of finding out what organ is diseased. If the outline is practically round or oval, the tumor probably originates in the ovary or tube; if the mass is flat it probably represents a portion of a tumor situated in the pelvic connective tissue. But there are many exceptions. Tubal tumors, especially pyosalpinx, may be associated with parametrial exudates and in that case exhibit qualities belonging to both tumors; or malignant ovarian tumors may, by infecting the pelvic connective tissue through the pedicle, produce extensive, flat, hard masses. On the other hand, a parametritic exudate may be round at the points where it is surrounded by peritoneum. The best way to guard against an error of this kind is to examine the entire outline of the tumor. If we decide that the tumor is in the pelvic connective tissue, it must be an exudate; for a carcinomatous growth, which yields similar palpatory findings, presupposes a primary focus. For further differential signs, especially in cases of recurrence, see p. 491. If the parametrium is excluded, on the other hand, the distinction between tubal and ovarian tumors must be made by the signs given on p. 462. Solid ovarian tumors may be further subdivided into neoplasms (fibroma, fibrosarcoma, sarcoma, carcinoma) and oöphoritis; while

hard tubal tumors may represent pyosalpinx, tubal moles following pregnancy, or neoplasms. For the differences see p. 463.

The **diagnosis of intraligamentary tumors** calls for separate discussion because certain characteristic properties of the tumors are obscured by the covering of connective tissue and peritoneum. The connection between the tumor and the uterus is less distinct; the shell of infiltrated connective tissue veils the contour and consistency of the tumor itself; tubal tumors are prevented from developing their characteristic shape; in short, the diagnosis of these tumors is very much more difficult. After the diagnosis of intraligamentary tumor has been positively made (see p. 322) and the uterine origin has been positively excluded, we must find out first whether the tumor is cystic or solid. If the walls are thick, forcible pressure must be employed for this purpose, and if this fails, the consistency must be tested through the rectum, which is often in contact with that portion of the tumor which is not intraligamentary. A cystic consistency indicates a parovarian, ovarian or tubal tumor (especially hydrosalpinx), or a fluid hematoma; the differences between these conditions are often exceedingly obscure. The diagnosis is even more difficult if the tumor is solid or if fluctuation cannot be positively demonstrated. The further differentiation of solid tumors is carried out in approximately the same manner as in the case of extraligamentary tumors, except that it is more difficult to recognize the various characteristics of the tumors. In the case of intraligamentary ovarian tumors the diagnosis is difficult because they are usually small papillary growths with distinct fluctuation and, if they are carcinomatous, infect the neighborhood so that their outlines become quite diffuse. Tubal tumors, especially pus-tubes, are usually surrounded by a thick shell of infiltrated tissue and fluctuation is difficult to detect. For the same reason the shape is indistinct, and even in hydrosalpinx covered merely with peritoneum it is difficult to recognize the characteristic convolutions, and the tubal origin is revealed only by the infiltrated uterine extremity. An intraligamentary exudate may closely resemble a myoma because it is smooth above and broadly attached to the uterus, especially if it does not extend into the deeper portions of the parametrium. Intraligamentary hematoma soon becomes hard and round and on palpation presents altogether different signs from those obtained with intraperitoneal extravasations of blood. The differential diagnosis of these conditions is very difficult and we are compelled to resort to the history and to observation of the patient more frequently than in the case of other tumors.

In the case of the true pelvis it is by no means so important to decide whether we are dealing with tumors of the genitalia or with

tumors of neighboring organs, as in the case of the large tumors previously described, because, owing to the limited space within the true pelvis, they soon come into such intimate relation with the genital organs that the diagnostic signs given in connection with the larger tumors are of no value. Nevertheless these tumors are, if possible, to be differentiated from the genitalia themselves, and it should at least be determined whether uterus and ovaries are normal. In this way it is possible to distinguish tumors of the periosteum, the pelvic bones, the pelvic glands, paratyphlitic exudates, and usually also tumors of the bladder and rectum from genital tumors. But if the pelvic connective tissue is included among the genital organs, as it must be for gynecologic purposes, certain difficulties arise; for there are certain forms of parametritic exudates which during the stage of absorption separate from the uterus and spread out along the pelvic bones in such a manner as to simulate bony tumors. The same thing occurs when these parts of the pelvis become the seat of carcinomatous neoplasms and recurrences. Owing to the intimate connection of these tumors with the genitalia it is often very difficult to make sure that the tumor does not originate in the sexual organs. I have experienced this difficulty several times in cases of rectal carcinoma which had involved the paraproctitic tissue as far as the uterus and simulated an exudate at this point, until the case was cleared up by a rectal examination.

I shall not carry this analytical discussion of the diagnosis of pelvic tumors any farther and refer the reader to the part devoted to special diagnosis for a study of the diagnostic signs of the individual tumors. It is merely my intention to indicate the manner in which the general practitioner arrives at a correct diagnosis by combined examination. To what extent the symptomatology, the history, and observation of the patient may assist in making the diagnosis has also been explained in the part devoted to special diagnosis.

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